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# PENICILLIN THERAPY IN OTORHINOLARYNGOLOGIC PRACTICE

F. HAROLD KRAUSS, M.D.
PHILADELPHIA

WITH penicillin being released for civilian use in adequate amounts, it has been possible to carry out studies in some of the specialty fields from which very few data have as yet appeared in the literature. Because the drug has been reported as being useful topically in combating infections, not only of battle injuries but also of mucous membranes, it was felt an attempt to determine its effectiveness in the treatment of infections of the upper respiratory tract, including infections of the paranasal sinuses and the middle ears, might well be worth while.[1] That the results would necessarily prove to be at all spectacular was not anticipated in view of some of the other publications in this field. For example, Herrell[2] in his recent book on penicillin therapy, on page 149, says in respect to the treatment of infected sinuses and ears:

> Since penicillin requires several hours to act on susceptible pathogenic organisms, it does not seem likely that local instillations would be sufficient to rid the region of bacteria present. Certainly deep seated infections involving these structures will scarcely be reached by local application of penicillin. While acute and subacute infections may respond to penicillin therapy only, I am inclined to the opinion that in chronic cases of long standing the greatest usefulness of penicillin lies in a combination of penicillin plus necessary surgical drainage.

In general, the results of this study have borne out Herrell's statements, but in many of these cases there was definite subjective clinical improvement. This was especially noteworthy in those cases in which my colleagues and I were reasonably certain that the penicillin solution reached the actual area of infection. This is best exemplified in cases in which puncture of the antrums was performed or displacement irrigation employed according to Proetz's method.

## MATERIAL

A total of 113 cases were studied including cases of acute and of chronic sinusitis, of otitis media, of mastoiditis, and of the usual acute infections of the upper respira-

1. The studies were carried out principally at St. Christopher's Hospital for Children and Abington Memorial Hospital, with a few patients representing private office practice.

2. Herrell, W. E.: Penicillin and Other Antibiotic Agents, Philadelphia, W. B. Saunders Company, 1945.

TABLE 1.—*Patients Treated with Penicillin by Proetz Displacement Method*

| Patient | Sex | Age | Diagnosis | History | Examination | Treatment | Result |
|---|---|---|---|---|---|---|---|
| Mrs. E. H. | F | 29 | Chr. ethmoiditis | Nose blocked constantly for 10 mo. following cold | Transill. clear; edema turb.; thin mucopus | Proetz 3/12 to 3/18 daily; drops every 3 hr. at house | 3/20: Nose almost normal 4/ 2: Breathing free, no discharge |
| Mr. G. O. W. | M | 25 | Chr. ethmoiditis | Since 1932 nose always blocked in a. m.; hawking and coughing; rt. ear discharged occasionally | Roentgenogram negative except clouding of ethmoid cells—hypertrophied mid. turb.; mucoid discharge from rt. ear | Proetz 3/8 to 3/17 daily; ear treated with pneumatic otoscope | 3/17: Symptoms relieved, nose dry; ear no better 5/2: Nose normal |
| M. G. C. | M | 26 | Chr. ethmoiditis | Unable to sing; voice without resonance; nose blocked constantly since October 1944 | Roentgenogram of sinuses; swelling of mid. turb.; small amt. pus mid. and sup. meatus | Treated with sulfathiazole and desoxyephedrine mixture; privine; from 11/5 to 3/7, no relief; pen. 3/14 to 3/19; 3/19 to 4/7 at home | 3/19: Better 4/ 7: Voice normal, able to give concert |
| Mrs. D. D. | F | 44 | Chr. ethmoiditis | Recurrent headaches; postnasal drip | Chr. ethmoid infection | Proetz for 2 wk. | Complete relief, no discomfort for first time in years |
| Mrs. O. F. | F | 39 | Chr. ethmoiditis | Nose blocked; discharge for 2 mo. | Hypertrophy mid. turbinates; small amt. pus | Proetz from 4/2 to 4/7 daily; drops every 3 hr. at home | Free breathing, no discharge 4/7; 5/13 still free of symptoms |
| Mr. C. H. | M | 47 | Chr. ethmoiditis Chr. dacryocystitis | Left eye wept | Hypertrophy left mid. turb.; red and engorged, pus mid. meatus | Proetz daily 4/9 to 4/14 daily; drops every 3 hr. at home | No marked improvement |
| J. B. | M | 7 | Persistent subacute rhinitis; chest clear | Nose blocked, cough, esp. at night, for 6 weeks | Edema all turb.; thin mucopus | Proetz 3/15; again 3/17; drops at home every 3 hr. | No cough after first treatment; no recurrence |
| M. F. | M | 8 | Chr. sinusitis | Headaches; blocked nose, recurr. frequently over 1 yr. | Swelling of turb.; pus in both nostrils | Proetz 3/19; daily for 6 days; drops at home | No headaches after first treatment; no recurrence |
| E. S. | F | 6 | Subacute rhinitis; chest clear | Cough, worse at night, for over a month | Moderate edema; small amt. pus | Proetz 3/26 every other day for 3 treatments | No cough after first treatment; no recurrence |
| F. T. | M | 4 | Subacute rhinitis | Cough, marked nasal discharge for 2 mo. | Swelling turb.; large amt. pus | Proetz 4/4 to 4/10; drops at home | No cough, discharge much less |
| S. B. | F | 8 | Subacute rhinitis | Cough; yellow expectoration; nasal discharge | Congestion of mucosa; pus in both nostrils | Proetz 4/5 to 4/10; drops at home | No cough; discharge much less |
| A. S. | F | 10 | Chr. sinusitis | Mouth breathing; nasal discharge; cough for 3 mo. | Pus in both nostrils | 4/5 to 4/13 Proetz daily | Nasal congestion less; cough persisting |
| J. K. | M | 12 | Chr. sinusitis | Headaches; nasal discharge | Edema turb.; pus in both nostrils | Proetz every 2 days, 4/18 to 4/28 | Headaches relieved, discharge clear but tenacious |
| A. | F | 6 | Sinusitis | Persistent fever of low grade; nasal discharge | Small amt. mucopus; hyperemic mucosa | Proetz 4/22 to 5/1 every 2 to 3 days | Temp. normal in 3 days—remained normal |
| H. | M | 18 | Sinusitis | Headache, cough | Pus in both nostrils; bronchitis | Proetz 4/24 to 4/29 | Cough and discharge less but follow-up impossible |
| E. O. | M | 11 | Chr. sinusitis | Constant profuse nasal discharge 2 yr. | Thick yellow pus filling both nostrils | Proetz 3/16 to 4/2; max. sinus irrigated; pen. instilled; patient admitted to hospital; 10,000 units pen. daily intravenously for 6 days | No improvement |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| R. K. | F | 7 | Chr. sinusitis | Frontal headache accompanied by blockage of nasal passage | Frontal headache accompanied by blockage of nasal passage, recurring frequently; not relieved by tonsill. and adenect. | Hypertrophy of turb.; pus in mid. meatus | No headaches; no pus seen; nose apparently normal |
| Mrs. M. L. | F | 35 | Acute max. sinusitis | Pain in rt. cheek 10 days—untreated | R. max. dark to transill.; pus in mid. meatus | Irrigation with needle puncture; 3 cc. penicillin instilled once only | Relief of pain; clear to transill. in 3 days |
| Mrs. H. K. | F | 39 | Acute max. sinusitis | Pain in rt. cheek and teeth following cold | R. max. dark to transill.; pus in mid. meatus | Irrigation with needle puncture; 3 cc. penicillin instilled once only | Relief of pain; clear to transill. in 3 days |
| Mrs. W. L. | F | 58 | Acute max. sinusitis | Pain in rt. cheek and teeth following cold | Engorgement of rt. mid. turb.; pus in mid. meatus; rt. max. dark to transill. | Irrigation with needle puncture; 3 cc. penicillin instilled once only | Relief of pain; clear to transill. in 4 days |
| Mr. F. C. | M | 43 | Acute max. sinusitis | Dec. 1944, acute left max.; washed 4 times, 5% sulfathiazole instilled; April 1945, acute rt. max. | Rt. max. dark to transill.; pus in mid. meatus | Irrigation with needle puncture; 3 cc. penicillin instilled once daily | Irrigation and instill. sulfathiazole; 4 washings; irrigation and instill. pen.; 1 washing; clean 3 days |
| Mr. G. B. | M | 54 | Acute max. sinusitis | Blocking and discharge in rt. nostril several months | Rt. max. dark to transill.; pus in mid. meatus | Irrigation with needle puncture; 3 cc. penicillin instilled twice, 3 days apart | Clear after 1 week; nose clear |
| Mrs. D. | F | 23 | Acute max. sinusitis | Acute attack 2 yr. ago; hospitalized and operation left window in left antrum; now pain on right side | Window in left antrum; right dark to transill. acute inflam. | Irrigation rt. with puncture, left with instillation pen. 3 times at 2 days' interval | No symptoms after second irrig.; clear after 3d irrig. |
| Mrs. H. M. | F | 52 | Acute max. sinusitis | Bilateral window 3 yr. ago; no trouble until 2 mo. ago; now nose filled with pus and discharges without warning—embarrassing (school teacher) | Intranasal windows; infec. meatus; patent pus discharge | Patient able to introduce pen. into antrums by posture; irrigation every 3 days at office | Marked relief in 5 days; no discharge after 2 weeks |
| C. S. | M | 61 | Bilateral max. sinusitis | Discharge for many years | Dark to transill.; pus in both mid. meatuses | Irrigation every 3 days; 3,000 units instilled | Left clear in 2 treatments; rt. clear in 4 treatments |
| C. Mc. C. | M | 24 | Chr. max. sinusitis | Discharge for 2 yr. | Dark to transill.; pus in both mid. meatuses | Irrigation every 3 days; 3,000 units instilled | Still under treatment by Dr. Miller |
| F. R. | M | 51 | Acute left max. sinusitis | Acute pain for 1 wk. | Dark to transill.; pus in left meatus | Irrigation every 3 days | Clear after 3d irrigation |
| P. S. | F | 8 | Chr. sinusitis | Nasal discharge at least 1 yr. | Crusting of mucous mem. both nares engorged; mucopurulent discharge from mid. meatus | Pen. Proetz started 3/26 to 4/2; treatment daily | Nose dry; 4/2: sinuses clear; 4/5: normal |
| C. D. | F | 10 | Chr. sinusitis | 10/16/44 in clinic for nasal discharge, mouth breathing | Mucopurulent discharge, enlargement of mid. turb. | 3/15 to 3/23 treatment daily with pen. Proetz | Now clear, no purulent discharge |
| E. St. J. | F | 11 | Chr. sinusitis; swollen eye, T. 105 F.; severe rhinitis | 2/10/45 frontal sinuses rudimentary—antrums and max. clear | Septum thick, erectile tissue high; mucopurulent discharge | 3/15 to 3/23 treatment daily with pen. Proetz | Nose clear, no pus in nose or pn. space |
| R. W. | M | 12 | Chr. sinusitis | Profuse discharge left nasal chamber; dizzy spells, treated for 2 yr. for sinusitis | Hyperthrophy of sinus | 4/8 to 4/19 treatment daily with pen. Proetz | Improved, subjectively after 1st treatment; no headache |
| J. G. | F | 6 | Chr. sinusitis | Constant cough and discharging nose for 6 wk. | Mucopus both nostrils purulent discharge | 3/20 to 3/30 treatment daily with pen. Proetz | No cough after 2 days; nose normal |

TABLE 2.—*Patients* Treated with Penicillin Drops Only*

| Patient | Sex | Age | Diagnosis | History | Examination | Treatment † | Result |
|---|---|---|---|---|---|---|---|
| I. A. | M | 51 | Chr. sinusitis | Profuse postnasal discharge | Mucopus; hypertrophied turb. | Penicillin for 10 days | No improvement |
| J. D. | M | 68 | Chr. ethmosphenoiditis (roentgen exam.) | Recurrent polyp for 20 yr.; frequent removals; headaches | Narrow nostrils; many polyps | Penicillin for 10 days; polyp removed | No improvement |
| H. D. | F | 57 | Chr. ethmosphenoiditis (roentgen exam.) | Postnasal drip 5 yr. | Pale, boggy mucous membranes | Penicillin for 2 weeks | No improvement |
| M. G. | F | 73 | Chr. ethmosphenoiditis | Polyps removed 4 times in past 15 yr.; no relief | Nasal passages filled with polyps | Penicillin for 3 weeks; polyps removed | Breathing free; no headaches for first time in 5 yr. |
| W. H. G. | M | 62 | Chr. ethmosphenoiditis | Chr. postnasal drip (10 yr.)—made worse by a cold | Postnasal drip; red pharynx; mucopus in nose | Penicillin for 3 weeks | No improvement |
| M. C. | F | 44 | Chr. ethmosphenoiditis | Postnasal drip at least 15 yr. | Discharge of mucopus from nose; pharynx red, dry | Penicillin for 2 weeks | No change |
| R. L. G. | M | 53 | Chr. ethmosphenoiditis | Perennial allergy and purulent discharge | Mucous mem. pale, but with pus discharge | Penicillin for 2 weeks | No improvement |
| O. H. | M | 54 | Chr. ethmosphenoiditis (roentgen diag.) | Hay fever, polyps, loss of smell; operations | Mucous mem. pale; no polyps; pus discharge | Penicillin for 2 weeks | No improvement |
| V. F. | F | 22 | Subacute rhinitis | Postnasal drip, mostly in morning | Postnasal discharge | Penicillin for 2 weeks | Subjective and objective improvement |
| K. R. | M | 32 | Ethmosphenoiditis | Nasal blockage; sphenopalatine pain; corneal ulcer | Thick septum; marked hypertrophy of mid. turb.; pus | Penicillin drops; penicillin in eye | Ethmosphen. improved; corneal ulcer healed |
| O. S. | M | 68 | Hyperplastic rhinitis with polyp | Several operations for removal of polyps; chr. postnasal discharge | Nasal polpys; postnasal discharge; culture taken | Penicillin for 3 weeks; polyps removed | Marked improvement |
| T. Y. | F | 48 | Hyperplastic rhinitis with polyp | Difficult breathing; postnasal drip; allergy | Many polyps; thick septum; hyper. turb. | Penicillin for 2 weeks; polyps removed | Improvement |
| Wea. | M | 12 | Rhinitis; bronchitis; tonsillitis | Cough and mouth breathing | Boggy turb.; thin mucopus | Penicillin from 4/10 to 4/15 inclusive | Breathing easier; discharge less; otherwise same |

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|---|---|---|---|---|---|---|---|
| Tha. | F | 20 | Chr. sinusitis; hyperplastic rhinitis for 10 yr. | Polyps removed several months before | Small polyps in both nostrils; hyper. turb. | Penicillin from 4/16 to 4/26 | No change |
| H. | M | 12 | Subacute rhinitis | Headaches; nasal discharge | Yellow pus in both nostrils | Penicillin from 4/19 to 4/26 | Less inflammation; no headaches; continuance of discharge |
| McN. | F | 2 | Acute rhinitis; otitis media | Discharge from nose and ear for weeks | Pus in both nostrils and in right ear | Penicillin from 4/20 to 4/27 | Much less discharge from nose and ear |
| A. J. A. | M | 55 | Acute ethmoiditis | Discharge from nose 10 days | Mucopus in both nostrils; transill. clear | Penicillin for 1 week | Complete recovery |
| F. G. | F | 42 | Acute bilateral ethmoiditis | Acute "cold" 1 week | Mucopus in both nostrils; transill. clear | Penicillin for 2 weeks | Much improvement |
| R. K. | M | 39 | Acute rhinitis | Acute "cold" 3 days; pain in both cheeks | Mucous mem. red; typical acute rhinitis | Penicillin for 3 days | Patient felt worse after drops |
| L. S. | M | 27 | Acute rhinitis, uncomplicated | Acute "cold" 2 days | Mucous mem. red; typical acute rhinitis | Penicillin for 4 days | Gradual improvement |
| W. W. | F | 41 | Acute rhinitis, uncomplicated | Acute "cold" 5 days | Mucous mem. red; typical acute rhinitis | Penicillin for 6 days | Nose normal 11 days after onset |
| D. M. | M | 18 | Acute rhinitis, uncomplicated | Acute "cold" 4 days | Mucous mem. red; typical acute rhinitis | Penicillin for 5 days | Nose almost normal 10 days after onset; recovery in 6 days |
| A. L. | F | 13 | Acute rhinitis, uncomplicated | Acute "cold" 3 days | Mucous mem. red; typical acute rhinitis | Penicillin for 3 days | Recovery in 6 days |
| L. S. | F | 10 | Acute rhinitis | Acute "cold" 3 days; headache | Typical acute rhinitis | Penicillin for 6 days | Nose clear after 8 days |
| J. C. | M | 36 | Acute rhinitis | Acute "cold" 4 days | Typical acute rhinitis | Penicillin for 3 days | Patient felt better after first day; cured in 7 days |
| A. M. | M | 47 | Acute rhinitis | Acute "cold" 2 days | Typical acute rhinitis | Penicillin for 6 days | Patient better after 2 days; cured in 8 days |
| D. H. | F | 52 | Acute rhinitis ‡ | Acute "cold" 1 day | Typical acute rhinitis | Penicillin for 4 days | Patient better after 3 days; cured in 5 days |

* Two patients in whom acute maxillary sinusitis developed which required antral puncture are listed elsewhere.
† The sodium penicillin was made up in a strength of 1,000 units to the cubic centimeter, and 10 drops of this solution was used in each nostril every 3 hours.
‡ About eight other patients with acute uncomplicated rhinitis were treated, in whom low grade ethmoiditis developed.

tory tract. These have been grouped according to the method of treatment as well as on the basis of diagnosis.

### PROCEDURE

Sodium penicillin [3] was used in all cases in a strength of 1,000 units to the cubic centimeter. In one series of cases Proetz's displacement therapy was employed. In another group the solution was instilled directly into the maxillary sinuses. In the less severe infections the topical administration of penicillin by nose drops alone was the procedure followed. In infections of the middle ear the penicillin was introduced directly into the middle ear by pressure, and finally the topical administration of the drug was fortified by parenteral administration, 10,000 units being given every three hours by intramuscular injection for two to five days. This method was particularly employed in cases of associated mastoiditis and chronic sinus infections.

The results in 47 cases in which treatment was by the Proetz displacement method were uniformly excellent. This was true with regard to infants and children and to adults. The treatments were given daily in the hospital, and the patient was instructed to use 10 drops of the penicillin solution in each nostril every three hours during the intervening period (table 1).

Proetz [4] has shown that by his displacement method fluid can be introduced readily into the sinuses and will remain there for periods varying from twenty-four to seventy-two hours. This is particularly important in the case of penicillin because of the importance of prolonged contact of the drug with the infecting organisms to secure their destruction.

Briefly stated, Proetz's technic consists of (1) inverting the patient's head so that the chin and the external auditory meatuses are in the same vertical plane, (2) instilling the medicament into the nose and (3) producing negative pressure (180 mm.) intermittently first in one nostril and then in the other. This is accomplished by compressing one nostril with the thumb or a finger while the patient closes the pharynx by saying "K."

The importance of using nonirritating antibacterial agents in treating infections of the upper respiratory tract is emphasized by Proetz in his book on page 62, where he says, "Effective antiseptics may yet be derived which are nonirritating to the sinus walls after continued contact, but I know of none at present. Certainly no antiseptic should be introduced in which there is any likelihood of decomposition into irritating components at body temperatures in the course of a few days."

It would seem that penicillin might well be that long sought for "effective antiseptic." In this series of cases in no instance has there been any irritation of the mucous membranes.

Approximately 25 per cent of the patients with various acute and chronic sinus involvements were treated solely by the use of penicillin

3. The sodium penicillin was supplied by Commercial Solvents Corporation.

4. Proetz, A. W.: Displacement Method of Sinus Diagnosis and Treatment, ed. 2, St. Louis, Annals Publishing Company, 1939.

nose drops. The penicillin solution was made up as previously noted in a strength of 1,000 units to the cubic centimeter, and 10 drops of this solution was used in each nostril every three hours. The patients were instructed to invert the head and to remain in this position for several minutes to permit as much penetration of the sinuses as possible. No other treatment was given except in a few instances in which small polyps were removed to facilitate breathing and to give better drainage.

The majority of these were private patients who were of better than average intelligence and cooperated readily. The results in this group, however, are rather inconsistent and not entirely satisfactory. Some, knowing of the magical properties of the drug, reported enthusiastically that they felt much better, although no objective improvement could be seen. Others suspicious of anything new or untried, stated that they felt no better, and in fact some few patients stated that they were worse. The results in this series of cases may be seen in table 2.

Four children ranging in age from 4 to 8 years had essentially identical complaints and histories, namely, persistent cough, sufficient to interfere with sleeping, accompanied by a moderate nasal discharge. They were treated with penicillin solution topically by the Proetz technic with pronounced relief of symptoms within twenty-four to forty-eight hours.

In 10 cases antral infection in adults following acute infections of the upper respiratory tract and characterized by the symptoms of pain in the cheek and the teeth, by the presence of pus in the middle meatus and by cloudiness of the antrums on transillumination was most gratifying in its response to treatment. In 6 of these cases the infection was cleared up after the second instillation, and in 2 cases, in which there were permanent windows in the inferior meatus from previous operations, the infection cleared promptly after instillation of penicillin solution every three hours for three days.

Individually some of the cases are of particular interest. There was one notable failure:

E. W., a boy of 10 years, had had a chronic discharge from his nose for several years. The turbinates were congested and boggy and did not shrink readily even with the use of the usual vasoconstrictors. A thick greenish pus could be aspirated from the nose in almost endless quantities. No improvement was noted in this boy after two weeks of treatment in which both the Proetz displacement method and nasal instillation of penicillin were tried. Roentgen examination showed marked thickening of the antral mucosa although there was no demonstrable retention of fluid. The antrums were irrigated by needle puncture, and penicillin solution was instilled without any appreciable change either objective or subjective. Cultures were taken, and the predominating organisms were found to be Staphylococcus albus. He was hospitalized and given 10,000 units of penicillin every three hours for five days. Again no improvement was noted, and he was given another course of penicillin with 0.5 Gm. of sulfadiazine every three hours.

TABLE 3.—*Patients with Otitis Media Treated with Penicillin by Proetz Technic and Use of Pneumatic Otoscope* *

| Patient | Sex | Age | Diagnosis | History | Examination | Treatment † | Result |
|---|---|---|---|---|---|---|---|
| D. S. | F | 5 | Chr. otitis media | Both ears running 2 weeks | Mucopus in both ears and both nostrils; no growth | Penicillin daily 3/29 to 4/10 | Ext. otitis developed; ear still running |
| J. P. | M | 9 | Chr. otitis media | Rt. ear running 2 weeks | Pus in nose and ear; Staph. albus | Penicillin daily 4/12 to 4/21 | Ear dry; recurrence later |
| D. R. | F | 9 | Chr. otitis media | Rt. ear running 3 days | Pus in nose and ear; Staph. albus | Penicillin daily 4/5 to 4/19 | Ear dry; 4/26: still dry |
| A. A. | M | 7 | Chr. otitis media | Rt. ear running 3 weeks | Pus in nose and ear; Staph. albus | Penicillin daily 3/29 to 4/4 | Ear dry; 4/5: still dry |
| M. S. | F | 4 | Chr. otitis media | Lt. ear running 1 week | Pus in nose and ear | Penicillin daily 3/5 to 3/23 | Ear dry; 3/29: still dry |
| M. Y. | M | 11 | Chr. otitis media | Lt. ear running 1 month | Pus in nose and ear | Penicillin daily 3/16 to 4/5 | Ear dry; recurrence later |
| R. M. | M | 12 | Chr. otitis media | Both ears running 15 days after measles | Pus in both ears and nostrils; discharge recurred 4/2 | Penicillin daily 3/29 to 3/31; 4/2 to 4/5; 4/16 to 4/19 | Ear dry; 4/23: still dry |
| R. M. H. | F | 10 | Chr. otitis media | Mastoid operation left ear 3/1/44; running since | Pus discharge left auditory canal; Staph. albus | Penicillin started 4/12; stopped 4/26 | Ear still running |
| J. T. | F | 8 | Chr. otitis media | Periodic discharge from left ear for several years | Roentgen exam.; culture positive for pneumo-diphtheroids. Staph. albus | Penicillin started 4/12; stopped 4/23 | Ear still running |
| R. K. | M | 6 | Acute otitis media | Ear ache 4/19 | Drum red, no discharge | Myringotomy; penicillin started 4/23; stopped 4/26 | Ear dry |
| M. B. | F | 13 | Chr. otitis media | Rt. ear discharging for several months | Roentgen exam.; chr. sclerosis; perforation of drum; heavy discharge with odor | Penicillin 1 week | No odor; ear dry |
| O. M. C. | M | 15 | Chr. otitis media | Both ears discharging for 5 years | Roentgen exam.; sclerosis all cells; offensive discharge from both ears | Penicillin 2 weeks | Ear dry; no odor |
| J. S. | M | 45 | Chr. otitis media | Foul discharge from both ears for 38 years | Discharge from both ears; polyp rt. side | Polyp removed; penicillin every 3 hr. for 4 weeks | Ear better; less discharge and odor; recurrence later |

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|---|---|---|---|---|---|---|---|
| D. W. | M | 30 | Chr. otitis media | Rt. ear discharging since childhood; dizzy spells; modified radical operation January 1944 | Chr. rt. otorrhea | Penicillin every 3 hr. for 2 weeks | No improvement |
| M. W. | F | 58 | Chr. rt. otitis media | Rt. ear discharging for 20 years | Drum gone; foul discharge; roentgen exam.: sclerosis, mastoiditis | Penicillin every 3 hr. for 3 weeks | Less odor and discharge; recurrence later |
| M. D. | .. | 41 | Chr. bilat. otitis media | Both ears discharging for 25 years | Large perforation of each ear | Penicillin every 3 hr. for 3 weeks | Slightly less discharge; odor less |
| I. C. L. | F | 57 | Chr. otitis media | Ear discharging since early youth | Attic perforation, discharge of pus | Massaged in mid. ear; penicillin every 3 hr. for 3 weeks | No change |
| E. H. | F | 67 | Chr. otitis media | Spontaneous rupture 3 weeks before seen | Large amount of pus in canal | Massaged in mid. ear; penicillin every 3 hr. for 3 weeks | Ear dry; perforation closed |
| J. W. | M | 8 | Chr. otitis media | Persistent otorrhea after mastoidectomy | Pus in canal | Massaged in mid. ear; penicillin every 3 hr. for 10 days | Ear dry; recurrence later |
| M. | M | 1 | Acute otitis media | Spontaneous rupture of right ear | Pus in canal of rt. ear | Massaged in mid. ear; penicillin every 3 hr. 4/7 to 4/10 | Ear dry |
| S. | F | 14 | Chr. otitis media | Ear discharging several years | Rt. otorrhea | Massaged in mid. ear; penicillin every 3 hr. 4/9 to 4/23 | No improvement (cooperation not good) |
| M. | M | 14 | Acute otitis media | Spontaneous rupture 1 day | Thin discharge through drum | Penicillin 4/18 to 4/20 inc. | Discharge ceased after 3 days |
| L. | M | 32 | Acute otitis media | Ear draining few days | Drum inflamed; slight discharge | Penicillin 4/16 to 4/20 | Condition subsided; no discharge |

* The patients listed in this table were treated in a special clinic at St. Christopher's Hospital for Children.

† After the auditory canal had been cleansed and dried, a solution of sodium penicillin, 1,000 units per cubic centimeter, was instilled, and was forced into the middle ear with a pneumatic otoscope. Each patient was given a penicillin solution to use at home as nose and ear drops.

No improvement was noted. Physical examination showed moderately enlarged and infected tonsils and large adenoids which were then removed. Improvement was immediate, and a follow-up shows no relapse.

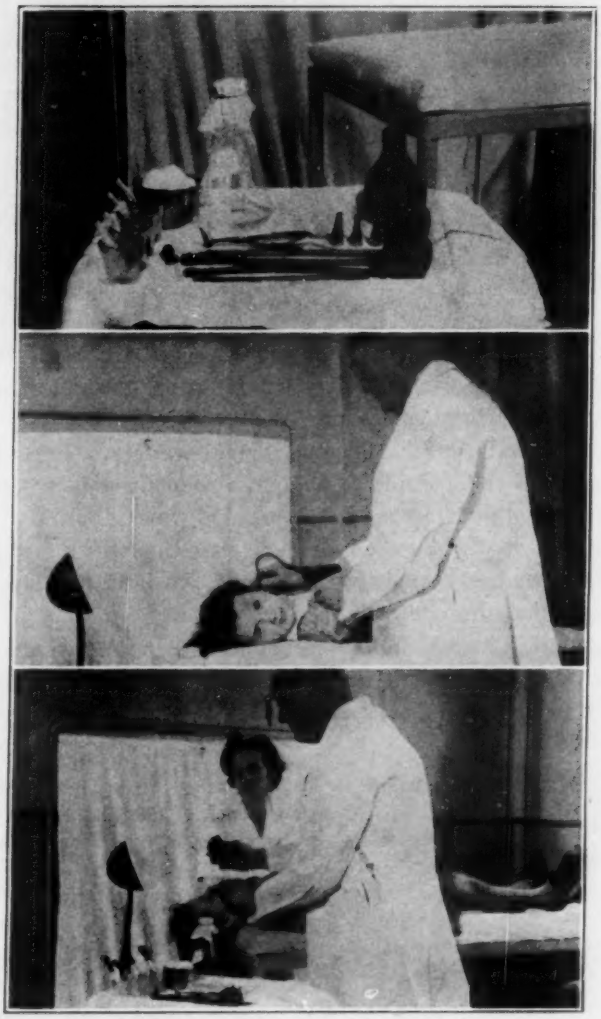
On the other hand, the condition of a number of the adult patients was gratifyingly improved by the Proetz technic.

G. C., aged 25 years, a singer, complained that his nose had been almost constantly blocked for five months during the winter. He had had a profuse postnasal discharge during this period and was unable to sing because of almost complete loss of resonance in his voice. He had been treated previously by other physicians with a number of other drugs including some of the sulfonamide preparations and vasoconstrictors without improvement. Roentgen examination of the sinuses revealed that the left frontal sinus was absent, that the mucosal lining of both maxillary antrums was thickened and that there was no retention of fluid. He was given daily Proetz displacement irrigations in the office for five days with a solution of penicillin containing about 1,000 units to the cubic centimeter and was instructed to use 10 drops of the solution in each nostril at intervals of three hours between treatments. He showed prompt improvement and continued to use the solution at home, employing a nasal suction apparatus which he built himself. At the end of three weeks he reported that his voice was practically normal and that his breathing was unobstructed. The following week he was able for the first time in six months to resume his concert singing and felt in every way normal.

CASE 3.—Mrs. E. H., a housewife aged 29 years, complained that her nose had been blocked constantly for almost a year since the preceding spring. This had followed a severe cold. She had used practically every variety of nasal medication available during that period without any beneficial effect. At the time of her first examination, in March, all the turbinates were found to be edematous and covered with a thick mucopurulent exudate. Transillumination of the maxillary and frontal sinuses showed no thickening of the lining membranes. She was treated once daily by the Proetz technic followed by instillation of 10 drops of penicillin solution every three hours at home for six days. At the end of this time her nose was almost normal. She had no recurrence of her trouble during the following two months up to the time at which this report was being prepared.

CASE 4.—J. A. W., a 38 year old man, complained that for twelve years his nose had been blocked regularly in the morning with a profuse nasal drip which was the source of great discomfort to him. At the time of the examination his right ear drum was perforated, and a thin mucopurulent discharge was noted. Previous treatment with the usual nose drops had proved to be ineffective. Roentgen examination of the sinuses revealed no essential abnormality. He was treated by the Proetz technic with penicillin solution daily for nine days, with the usual nasal drops every three hours at home during the interval between office visits. The middle ear was likewise treated with the penicillin solution by means of the pneumatic otoscope. Clinically, he showed such striking improvement that he felt that he did not need further treatments. With the completion of this series of treatments, examination showed the turbinates to be much smaller in size, and no exudate or secretions were noted. He was seen some two months later and stated that he had had no complaints up to that time, that his nasal passages had been clear and that he was no longer bothered by the postnasal drip. The ear still showed some discharge, however.

In the group of cases of chronic otitis media there was usually concomitant sinusitis, evidenced by engorged or hypertrophied turbinates and by visible pus. In the majority of these cases there was a marked improvement in the nasal condition without any definite correlation to the inflammatory condition of the middles ear (table 3).



Instruments and methods employed in the special clinic at St. Christopher's Hospital for Children for patients with chronic infections of the ear.

In the treatment of chronically discharging ears, the method suggested by Swanson and Baker [5] was used. This consists, briefly, in

5. Swanson, C. A., and Baker, D. C., Jr.: The Use of Penicillin in Diseases of the Ear, J. A. M. A. **126**:616 (Nov. 4) 1944.

cleansing and drying the auditory canal, instilling a solution of penicillin, 1,000 units to the cubic centimeter, and then forcing it into the middle ear with a pneumatic otoscope by using alternate positive and negative pressure.

A special clinic was organized at St. Christopher's Hospital for Children, and all patients with chronic infections of the ear were referred there. We used a Politzer bag with a short length of rubber hose tipped with a diagnostic ear piece (fig.). These patients were given the treatment outlined daily at the hospital and were given a solution of penicillin to use at home as nose and ear drops every three hours. In employing the drops in the ears they were to clean and dry the ear canal with cotton pledgets.

The results of this form of treatment were confusing and difficult to analyze. The general impression was that the penicillin was of little value. To be sure, a few of the ears promptly stopped running and stayed dry; with others the running stopped and then recurred after a short time; most were unaffected. It was thought that the greater attention given to the ear, i. e., regular and more frequent cleansing of the ear, was largely responsible for the improvement shown.

Penicillin administered intramuscularly seems to have the same masking effect as sulfonamide compounds when there is abscess formation and breaking down of bone in the mastoid process. But when drainage is established, we have found in all cases in which penicillin was administered that the wound was dry after two or three days and that healing was immeasurably hastened.

In acute otitis media due to penicillin-susceptible organisms, penicillin (10,000 units injected intramuscularly every three hours) gives much more prompt relief and faster remission of the disease than do sulfonamide compounds.

CASE 5.—A man aged 21, while on leave from the Navy, suffered an attack of otitis media. He was admitted to Abington Memorial Hospital with a temperature of 106 F. Myringotomy released serosanguineous fluid under pressure (a culture showed hemolytic streptococci). Administration of penicillin, 10,000 units intramuscularly every three hours, was started. The temperature promptly fell to normal within three hours, and remained there. In three days the ear was perfectly dry, and in seven days the drum was healed. Hearing was normal, and the patient was able to return to duty (table 5).

From mid-March 1945 to date, we have had 12 cases of acute mastoiditis that required simple mastoidectomy (in 1 case there was the complication of an epidural abscess). These patients were given penicillin (usually 10,000 units every three hours intramuscularly) just before and after operation. Without exception, the middle ear and wound were dry in an average of three days instead of the usual seven to ten days or longer. Packing which was used only to control bleeding

we have found it advisable to remove before the third day because of the rapid repair of the wound.

One of the most dramatic responses to penicillin administered parenterally was in a nurse who had suffered from severe headaches and profuse nasal discharge since her student days, eight years before. She had had five operations on the sphenoid, ethmoid and maxillary sinuses with but little relief. Sulfonamide drugs were ineffective after repeated courses of treatment. In the early part of March 1945 100,000 units of penicillin was administered parenterally daily for

TABLE 4.—*Patients with Mastoiditis Treated with Penicillin Intramuscularly*

| Patient, Sex and Age | Diagnosis | History | Examination | Treatment | Result |
|---|---|---|---|---|---|
| S. W. M 3 | Mastoiditis | Bilateral myringotomy 2 weeks before | Both ears discharging; tenderness of tips; temp. 104 F. | Hospitalized; pen. 5,000 units every 3 hr. for 5 days; roentgen exam.: both mastoids clouded; pen. 14,000 units; course of sulfadiazine before hospitalization | Tem. 98 F. after 1 day; ear dry and drum healed |
| S. F. M 16 | Mastoiditis | Discharge from right ear for 24 days | Tenderness of tip; drooping canal wall; simple mastoidectomy | Hospitalized; pen. 15,000 units every 3 hr. for dose of 300,000 units; roentgen exam.: destruction in cells; sulfadiazine 24 days until chill and fever developed | Ear dry in 3 days |
| G. A. F 2½ | Mastoiditis | Discharge from right ear for 2 weeks | Tender mastoid; fever; profuse discharge; simple mastoidectomy | Pen. 5,000 units every 3 hr. for 5 days; roentgen exam.: mastoiditis; sulfadiazine prior to admission | Ear dry in 4 days |
| J. C. 8 | Mastoiditis | Discharge from both ears for 2 weeks; 4 days later acute pain and discharge in left ear | Pulsating discharge from both ears; operation; simple mastoidectomy | Hospitalized; pen. 5,000 units every 3 hr. for 4 days; roentgen exam.: bilateral involvement; pen. 5,000 units; treated with sulfadiazine 2 weeks before | Temp. normal and no discharge; after 4 days sent home; ear dry |

five days. After the third day, the nose was dry, and the only discomfort was an increase in pain in the facial region for about a half hour after each injection. Two months after this course of treatment, she was still free of symptoms, and on examination the nose was dry, no granulation tissue or polyps were found in the nose, and there had been no relapse during this interval, in which she had gained 15 pounds (6.8 Kg.).

On the other hand, another woman with a somewhat similar history of acute infection of the right frontal sinus twenty-three years earlier followed by a modified radical operation at that time had been free of symptoms until about one year before her present illness. At that time she suffered an attack of severe pain in the left frontal region with swelling and spontaneous rupture through the scar in the left eyebrow. Since that time there has been almost constant drainage of a

thin mucopurulent pus. She refused further operation, and so 100,000 units of penicillin was administered parenterally daily for five days. She showed no benefit from this treatment.

CASE 8.—Mr. H. W., a person with diabetes, had complained of constant postnasal discharge for many years. This was so pronounced that it would awaken him several times each night, when he would have to raise the exudate before he could go back to sleep. The turbinates were boggy, and there was considerable pus in the sphenoethmoid recess. Transillumination of the frontal and maxillary sinuses showed no fluid or thickening of the mucous membranes. He was given 100,000

TABLE 5.—*Patients with Sinusitis Given Penicillin Parenterally*

| Patient, Sex and Age | Diagnosis | History | Examination | Treatment | Result |
|---|---|---|---|---|---|
| N. H. F 34 | Sinusitis | Since 1929, 15 operations, ethmosphenoid and max. sinuses; frequent removal of polyps | Almost constant headaches; nasal discharge profuse; no polyps now | 3/16 penicillin started; 100,000 units, 6 vials | After 3 days no discharge but severe pain, frontal, constant; after 5 days no pain; normal to present; gained 15 lb. (6.8 Kg.) |
| E. B. F 42 | Chronic sinusitis | Radical left frontoethmoid operation in 1935; clear until 1943, when acute attack left frontal caused spontaneous rupture above eyebrow; drained constantly; seen 11/22/44 | Treated with 20% sulfathiazole crystals in sinus tract; no improvement; refused operation | 4/5 penicillin started; 100,000 units, 6 vials; repeated twice | No improvement; since this article was written a radical frontal operation was performed and a total of 500,000 u. of penicillin given with complete recovery |
| H. W. M 61 | Chronic sinusitis | Treated for "years" for chronic sinusitis with polyps | Constant purulent discharge; blockage, hawking and spitting; sleep disturbed; no polyps | 3/19 penicillin started; 100,000 units, 5 vials | 3/26, nose almost normal; able to sleep all night, comfortable breathing; 4/2 condition still good |
| | | | | Treatment | |
| Naval cadet home on leave M | Acute sinusitis | 2/2[illegible]/45: pain previous night in left ear; admitted to Abington Hospital; T. 106 F.; myringotomy; profuse serosang. discharge 3 p. m.; at 8 p. m., T. 98 F. | | 2/28 penicillin started, 10 ampules; 3/1 T. 98 F., profuse discharge; 3/2 T. 98 F., less discharge; 3/3, T. 98 F., ear dry; 3/4 T. 98 F., perforation healed; 3/5 discharged from hospital; 3/8 perforation healed, hearing normal with audiometer; 4/18 hearing normal, drum normal | |

units of penicillin intramuscularly daily for five days. Seven days from the start of this therapy his nasal mucosa was normal in appearance. He was able to sleep at night, and there was no postnasal discharge. He remained free of symptoms for the following two months.

## SUMMARY AND CONCLUSIONS

This study on penicillin as used topically in the treatment of infections of the upper respiratory tract gives evidence of the drug's being of definite value in the great majority of cases when it is administered in adequate dosage and by the usual well established technics. Used as

nose drops alone it is of doubtful value, although many individual patients were undoubtedly benefited by even this relatively ineffective method of administration. When the Proetz displacement method is employed or when direct instillation of the penicillin is possible, the results in many of the cases have been striking and appear to be much more satisfactory than those with any other form of treatment, including the use of the sulfonamide drugs. In cases of chronic infection of the ear penicillin does not seem to be of any particular value, but in cases of acute infection the ears dry up in a matter of two to three days instead of in the usual week to ten days. In cases of mastoidectomy the benefit from topical administration is somewhat variable, but as a rule the area granulates more promptly because of control of the infection. When topical administration is supplemented by parenteral administration, the clinical results are much more striking; this would seem to represent the method of choice.

It may be said that the topical use of penicillin presents a definite step forward in otorhinolaryngologic practice, although the results are not so dramatic as those observed in fulminating infections when the drug is employed parenterally. However, in spite of the rather encouraging results found in this study we feel that further work should be done before any final conclusions are drawn.

Assistance in this study was provided by Dr. M. Valentine Miller, Dr. George Faris and Dr. Frank Follweiler.

1930 Chestnut Street.

# PENICILLIN IN PERITONSILLAR ABSCESS AND PERITONSILLAR PHLEGMON

## A Report of Penicillin Therapy in Twenty-Five Cases

CAPTAIN ABRAHAM ROSENBERG
MEDICAL CORPS, ARMY OF THE UNITED STATES

THE STUDY reported in this paper was undertaken with a definite purpose in mind, namely, to establish the efficacy of penicillin in a suppurative process of the throat and to study its therapeutic value as well as its limitations. In the area in which Army medical doctors were operating in Germany there was a fairly large number of patients with acute peritonsillar phlegmon and peritonsillar abscess. These patients were seen and studied during the summer months, when this condition is seen least frequently. Another interesting feature was the type of patients. They were all able-bodied men, mostly military personnel, in the age group between 21 and 41 years. These men were all treated after V-E Day.

Every patient was hospitalized and the penicillin therapy standardized. Some had been previously treated with sulfonamide drugs. This has been recorded and integrated in the conclusions of the article.

The total dosage decided on was 200,000 Oxford units of the sodium salt of penicillin, given intramuscularly, 20,000 Oxford units every three hours. All patients were seen by one observer, and each case was observed from the beginning of penicillin therapy until the completion of the case and the discharge of the patient from the hospital. When first observed each patient had signs of a peritonsillar abscess or phlegmon. I distinguish between the two conditions. In one there is definite pus, while the other is a cellulitis. The exact time that peritonsillar inflammation started could not be determined. Instead, the date when the patient complained of subjective symptoms of sore throat was used.

### REPORT OF CASES

CASE 1.—The patient, aged 24 years, first complained of a sore throat on July 1. Penicillin routine was started on July 3. When examined on July 3 he had a peritonsillar abscess on the left side, with a definite localized bulging. On July 6 the abscess was incised and drained.

CASE 2.—The patient, aged 23 years, complained of symptoms of a sore throat on July 3. From July 5 until he was admitted to the hospital he took 7 Gm. of a sulfonamide drug by mouth. Examination in the clinic on July 6 revealed a peritonsillar abscess on the right side, with edema of the uvula. On the same

day he was placed on the penicillin routine as described. He received a total of 140,000 Oxford units of penicillin. On July 7 the abscess was incised and drained.

CASE 3.—The patient, aged 27 years, first complained of symptoms of a sore throat on July 5. On July 6 he was placed on sulfonamide therapy by his dispensary. The total amount of sulfonamide compound taken was 9 Gm. On July 7 he was examined in the clinic for the first time. There were diffuse redness and edema around the left tonsil. On the same day that he was examined penicillin therapy was started. He received a total of 140,000 Oxford units of penicillin. The abscess was incised on July 8.

CASE 4.—The patient, aged 26 years, first noticed symptoms of sore throat on July 5. Sulfonamide drugs were given by mouth on July 6, the patient having received 5 Gm. of a sulfonamide compound. When first observed, on July 7, the uvula was edematous and there was also a slight amount of edema and redness around the right tonsil. On July 8, after the patient had received 200,000 units of penicillin, there was a definite improvement. On the following day the edema had entirely subsided.

CASE 5.—The patient, aged 26 years, first complained of subjective symptoms of sore throat on July 3. He was treated with sulfonamide drugs by mouth, receiving 0.5 Gm. of a sulfonamide compound by mouth every two hours from July 4 through July 7. When first observed in the clinic, on July 7, the patient's uvula was edematous and there was a moderate amount of edema around the left tonsil. Penicillin therapy was immediately started. When the patient was examined on July 8, there was some local improvement. By July 10, the inflammatory process had entirely subsided and the patient was ready for discharge.

CASE 6.—The patient, aged 23 years, first noticed symptoms of sore throat on June 30. On July 7 treatment with sulfonamide drugs was started by mouth. He received an initial dose of 3 Gm. of a sulfonamide drug and 1 Gm. every four hours thereafter. On July 8 examination revealed edema around the left tonsil. The patient was placed on penicillin therapy on the same day. On the following day the edema and redness had decreased, and on July 10 the patient was free of symptoms of sore throat.

CASE 7.—The patient, aged 25 years, first noticed symptoms of a sore throat on July 6. Examination on July 9 revealed a small amount of edema around the right tonsil. Penicillin therapy was started on the same day. The patient was relieved of pain within twenty-four hours. Two days later the inflammatory process had entirely subsided.

CASE 8.—The patient, aged 21 years, first noticed that his throat was sore on July 7. On the following day sulfonamide therapy by mouth was instituted, the patient receiving a total of 6 Gm. of sulfonamide drugs. On July 9 examination of the patient's throat revealed edema of the uvula and a moderate amount of edema and redness around the right tonsil and soft palate. On the same day penicillin therapy was started. On July 11 the patient showed signs of improvement, and on the following day all evidence of peritonsillar involvement had disappeared.

CASE 9.—The patient, aged 41 years, first complained of subjective symptoms of sore throat on July 6. On July 10, when he was examined, I observed edema of the uvula and some edema and redness around the left tonsil. On the same day penicillin therapy was instituted, the patient receiving a total of 200,000 Oxford units intramuscularly. Within two days the patient was well.

CASE 10.—A soldier, aged 21 years, first complained of subjective symptoms of a sore throat two weeks prior to admission to the hospital. He was admitted to our hospital on July 10, when examination in the clinic revealed a moderately severe edema and redness around the left tonsil. He had been treated with sulfonamide drugs by his medical officer, the amount taken not being known by the patient. On July 10 penicillin therapy was started, and within forty-eight hours the peritonsillar inflammation had subsided.

CASE 11.—A soldier, aged 31 years, complained of symptoms of a sore throat for two weeks prior to admission in the hospital. On July 8 he noticed that the right side of his throat had become more sore and painful. On July 11 examination in the clinic revealed a moderate amount of redness and edema around the right tonsil. On the same date he was placed on penicillin therapy. On the following day an improvement was noted. On July 14 all signs of edema had disappeared.

CASE 12.—The patient, aged 36 years, first complained of a sore throat on July 8. On the following day he was treated with sulfonamide compounds by mouth, being given 1 Gm. of a sulfonamide drug every four hours. Treatment with sulfonamide compounds was continued through July 11. On July 12 he was placed on penicillin, administered intramuscularly. On admission, examination revealed edema of the uvula and a moderate amount of edema of the soft palate. On July 13 the redness and edema around the left tonsil had subsided.

CASE 13.—On July 9 a soldier, aged 28 years, complained of sore throat and dysphagia. Two days later the patient was treated with a sulfonamide compound by mouth. Treatment was continued through July 12 by his medical detachment. On July 13 examination of this patient's throat showed edema of the uvula and a moderate amount of edema around the left tonsil. He was placed on routine penicillin therapy, receiving the usual amount intramuscularly. Local signs of inflammation began to disappear in twenty-four hours.

CASE 14.—On July 12 the patient, aged 28 years, complained of subjective symptoms of sore throat. On July 15 examination of the patient's throat revealed a slight amount of redness and edema around the left tonsil. On the same day penicillin therapy was instituted. The response to penicillin was good. The peritonsillitis subsided, but it flared up again on July 20.

CASE 15.—The patient, aged 28 years, first complained of dysphagia on July 12. On July 16 he received a total of 5 Gm. of a sulfonamide drug by mouth. On that same day he was admitted to the hospital. Examination of the throat revealed a moderate amount of redness and edema of the soft palate. There were pronounced edema and redness in the peritonsillar area on the right side. Penicillin therapy was started on July 16. On July 18 edema had subsided, but there was a definite circumscribed bulging area above the upper pole of the right tonsil, which ruptured spontaneously on the same day.

CASE 16.—The patient, aged 28 years, complained of subjective symptoms of sore throat on July 15. On July 17 he was seen in our clinic the first time. On examination I noted a slight amount of edema and redness in the peritonsillar region on the left side. Penicillin therapy was started as soon as he was admitted to the hospital. Within forty-eight hours all objective signs of peritonsillar inflammation had subsided.

CASE 17.—A man, aged 28 years, first complained of a sore throat on July 14. On July 18 examination of his throat revealed a moderately severe edema of the

left peritonsillar area. Penicillin therapy was instituted on the same day. He received the usual amount of penicillin. On July 19 the acute process had localized. On July 20 the abscess was incised to relieve the dysphagia.

CASE 18.—On July 17 a patient, aged 26 years, noticed that his throat was sore and swallowing was painful. He was examined on July 19 in our clinic. Examination of his throat revealed a slight amount of redness and edema in the peritonsillar area on the left side. Penicillin therapy was started on the same day. On the following day local signs of inflammation had quieted down.

CASE 19.—The patient, aged 34 years, complained of subjective symptoms of a sore throat on July 16. On July 21 he was examined in the clinic the first time. We observed edema of the uvula and moderate edema around the left tonsil. There were diffuse redness of the soft palate and an area of definite localization. My colleagues and I felt that the patient had a peritonsillar abscess. Penicillin therapy was instituted on the same day. On the day prior to admission to the hospital the patient had received 130,000 Oxford units of penicillin. Later in the day the abscess ruptured spontaneously.

CASE 20.—A soldier, aged 27 years, complained of a sore throat and painful swallowing on July 23. On July 24 sulfonamide therapy was started by mouth by his medical officer. On the following day the patient was placed on routine penicillin therapy at our hospital. On July 26 examination of the patient's throat revealed extensive edema of the soft palate and uvula, with a definite area of bulging in the left peritonsillar region. Within twenty-four hours, the edema had subsided and the patient was clinically improved.

CASE 21.—The patient, aged 25 years, first complained of dysphagia on July 30. On July 31 he was given 7.5 Gm. of a sulfonamide drug in the divided doses by mouth. On August 2 examination of his throat revealed edema of the uvula and edema and redness of the right peritonsillar area. On the same day penicillin therapy was started. On August 3 local signs of inflammation began to subside.

CASE 22.—The patient, aged 32 years, complained of a sore throat on August 3. On August 3 and 4 he received at least 10 Gm. of a sulfonamide drug by mouth in divided doses. On August 5 he was examined in the clinic. At that time there were moderate redness and a moderate amount of edema in the left peritonsillar region. On the same day penicillin therapy was started. Within twenty-four hours the patient felt better and the edema and redness of the soft palate had decreased.

CASE 23.—A soldier, aged 36 years, complained of a sore throat and dysphagia on July 29. On August 1 he was treated with penicillin, receiving 20,000 units every three hours. The total amount of penicillin given was 300,000 Oxford units. On August 7 the patient was seen for the first time in our clinic. There was definite localization in the right peritonsillar region. The abscess was incised and drained on the same day.

CASE 24.—The patient, aged 27, complained of dysphagia and sore throat on August 11. He was given medication by mouth in his dispensary, but he did not know the name of the medicament. On August 13 he was examined in the clinic. The uvula and soft palate were red and edematous, and there was some localization in the right peritonsillar region. Penicillin therapy was started on the same day. On the following day local signs of inflammation had subsided somewhat. On August 15 dysphagia was not so severe as the day before. On August 16 all local signs of inflammation had cleared up.

CASE 25.—The patient, aged 22, complained of dysphagia and sore throat on August 15. On the following day he was admitted to the hospital. Examination of the throat revealed edema and redness of the right peritonsillar area and moderate edema of the soft palate. Penicillin therapy was started on the same day. Within twenty-four hours the patient felt clinically better and local signs of inflammation had begun to subside.

I realize that a question may be raised as to the end results of any therapy in peritonsillar abscess. These abscesses may rupture at any time. The patients were carefully watched and were closely questioned as to the possibility of spontaneous rupture and evacuation of the pus present in the lesion. For the past few years there has been a tendency to treat surgical conditions by penicillin, obviating surgical intervention. With this fact in mind the study was made to assay and weigh carefully the effect of this type of therapy and to reach definite conclusions as to limitations. That it is of value in the treatment of peritonsillar phlegmon which complicates acute tonsillitis seems definitely proved by the results obtained in this series of cases.

## COMMENT

In this paper 25 cases of peritonsillar abscess and peritonsillar phlegmon were studied. On the basis of previous experience, it was decided that 200,000 Oxford units of penicillin, divided into ten doses of 20,000 units given every three hours, would be given intramuscularly to each patient. The patient in case 23 received 300,000 units of penicillin. The patients in cases 1, 2, 3, 17 and 23 required incision and drainage. Abscesses of patients in cases 15 and 19 ruptured spontaneously. In the remainder the acute inflammatory process subsided under treatment with penicillin. The dosage of penicillin decided on seems to be adequate for such treatment. The patient in case 1 received penicillin about forty-eight hours after the onset of symptoms of sore throat. It did not cure the patient. An abscess formed, and it required incision and drainage. The patient in case 2 received both a sulfonamide drug and penicillin but required incision and drainage for relief of symptoms. The patient in case 3 received 9 Gm. of a sulfonamide drug within twenty-four hours of the onset of symptoms, and, in spite of treatment with 140,000 Oxford units of penicillin, within forty-eight hours incision and drainage were required. The patient in case 4 was treated with 5 Gm. of a sulfonamide compound by his dispensary but improved only after penicillin therapy was instituted at the hospital. The patient in case 5 was treated with a sulfonamide drug by a unit dispensary, receiving 0.5 Gm. of a sulfonamide compound every two hours from July 4 to July 7. There was no improvement in symptoms until he was treated with penicillin. The patient in case 6 was treated with a sulfonamide drug for one day but with little beneficial effect. How-

ever, when he was treated with penicillin, the local signs of peritonsillitis subsided. The patient in case 8 received 6 Gm. of a sulfonamide drug by mouth but did not improve until penicillin was used. The patient in case 12 was treated for three days with a sulfonamide compound by mouth. Improvement was noted only after penicillin therapy was started. The patient in case 13 was treated with a sulfonamide drug for two days but improved only when penicillin was used. The patients in cases 21 and 22 received respectively 7.5 and 10 Gm. of a sulfonamide drug, with little relief. Improvement in these cases followed only after penicillin therapy was instituted. Each patient in this series of cases received irrigations of warm isotonic solution of sodium chloride frequently throughout the day.

## CONCLUSIONS

1. Penicillin has a secure place in the therapy of peritonsillar phlegmon.

2. Penicillin is superior in its therapeutic results to sulfonamide compounds.

3. If used early penicillin may avert abscess formation and subsequent incision and drainage.

4. The treatment of peritonsillar abscess is incision and drainage.

Hq. Theatre Service Forces, European Theater,
APO 757, % Postmaster, New York, N. Y.

# GINGIVAL HEMORRHAGE WITH ORAL MANIFESTATIONS IN HEREDITARY HEMORRHAGIC TELANGIECTASIA

## Successful Control with Sclerosing Agent Sylnasol*; Effect of Vitamin P and Nicotinic Acid; Role in Case Reported Which Was Observed Five Years

SAMUEL PELUSE, M.D.
LOS ANGELES

GINGIVAL hemorrhage in hereditary hemorrhagic telangiectasia has been referred to frequently since Rendu,[1] in 1896, first recognized this symptom complex and Osler,[2] in 1901, created it as a clinical entity. However, a careful review of the literature has failed to disclose a detailed and illustrated report of a case of gingival hemorrhage and oral manifestations in this malady.

Goldstein [3] in 1931 compiled a comprehensive historical review of oral hemorrhages in hereditary hemorrhagic telangiectasia from 1876 to 1930 inclusive, and for a more detailed bibliography the reader is directed to his article.

References to gingival hemorrhage with no further descriptive details have been made by numerous observers, but this symptom apparently, up to the present, has been recorded as a minor episode in conjunction with the more alarming nasal, oral and other hemorrhages which occur in the course of this disease.

Phillips [4] (1908) mentioned a death from hemorrhage of the gum in addition to bleeding from the tongue; Josserand's [5] (1902) patient

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From the Department of Otolaryngology of the Good Hope Clinic.

* Sylnasol is a 5 per cent solution of the sodium salt of fatty acids of a vegetable oil extracted from a seed of the psyllium group.

Paper read and patient demonstrated before: (*a*) the staff of the Queen of Angels Hospital, Los Angeles, March 11, 1942, and (*b*) the Los Angeles Society of Ophthalmology and Otolaryngology, March 23, 1942. (Since the original presentation of this paper, essential chronologic data have been added.)

1. Rendu, M. P.: Épistaxis répétées chez un suject porteur de petits angiomes cutanés et muqueux, Bull. et mém. Soc. méd. d. hôp. de Paris **13**:731 (Oct. 23) 1896.

2. Osler, W.: A Family Form of Recurring Epistaxis Associated with Multiple Telangiectasis of the Skin and Mucous Membranes, Bull. Johns Hopkins Hosp. **12**:333, 1901.

3. Goldstein, H. I.: Goldstein's Heredofamilial Angiomatosis, Arch. Int. Med. **48**:836 (Nov.) 1931.

4. Phillips, S.: A Case of Multiple Telangiectasis, Proc. Roy. Soc. Med. (Sect. Laryng.) **1**:45 (March) 1908.

5. Josserand, J., cited by Hanes.[11]

bled from the gums, lips and tongue, Laffont's [6] (1909) bled from the gums and face, Hutchison's and Oliver's [7] (1916) from the gums and mouth, Steiner's [8] (1917) from the gums and nose and Harper's [9] (1929) from the gums, nose and tongue; Stock [10] (1944) reported I case in which "Profuse spontaneous hemorrhage from the nose and gums had necessitated two transfusions in the past." Other similar reports have appeared in the literature, but no advantage is gained by listing them.

The term "hereditary hemorrhagic telangiectasia" was first advocated in an excellent article by Hanes,[11] in 1909, and in his concluding paragraph he stated, "I suggest that this affection be called Hereditary Hemorrhagic Telangiectasia, a name which I believe not only adequately describes the condition, but conforms to the strictest rules of medical nomenclature."

He further aptly defined this condition as "An hereditary affection manifesting itself in localized dilatations of capillaries and venules, forming distinct groups of telangiectases which occur especially upon the skin of the face, nasal and buccal mucous membranes, and give rise to profuse hemorrhage either spontaneously or as the result of trauma."

Various titles have been ascribed to this malady, namely, Osler's disease, Rendu-Osler's disease, Rendu-Osler-Weber's disease and others. The term Osler's disease is the one most commonly used to identify this disease, but for greater simplicity and uniformity and to avoid further confusion, retention of the descriptive title of hereditary hemorrhagic telangiectasia, as proposed by Hanes,[11] is in keeping with the present day trend.

The three cardinal findings for the establishment of a diagnosis of hereditary hemorrhagic telangiectasia are contained in Hanes's [11] definition, as quoted, and they are as follows: (1) hereditary tendency toward the disease; (2) the presence of telangiectatic areas, typically distributed, and (3) the tendency of these telangiectatic areas to bleed.

### HEREDITARY TENDENCY TOWARD THE DISEASE

Hanes [11] stressed the dominance of heredity with, "the hereditary tendency to the disease is by far the most striking and constant. With

6. Laffont, A.: Télangiectasie héréditaire hémorragique et angiomatose miliaire, Presse méd. **17**:763 (Oct.) 1909.

7. Hutchison, R., and Oliver, W. J.: Multiple Telangiectases with Epistaxis of the Familial Type, Quart. J. Med. **9**:67 (Jan.) 1916.

8. Steiner, W. R.: Hereditary Hemorrhagic Telangiectasia, Arch. Int. Med. **19**:194 (Feb.) 1917.

9. Harper, R. A.: Multiple Hereditary Telangiectasis with Recurring Hemorrhages, Newcastle M. J. **9**:182 (April) 1929.

10. Stock, M. F.: Hereditary Hemorrhagic Telangiectasia (Osler's Disease), Arch. Otolaryng. **40**:108 (Aug.) 1944.

11. Hanes, F. M.: Hereditary Hemorrhagic Telangiectasis, Bull. Johns Hopkins Hosp. **20**:63 (March) 1909.

the exception of Hemophilia, there is no other disease which, so like a nemesis, pursues its victims through successive generations." Steiner [8] further emphasized the constancy of this trait by stating, "In its causation, a hereditary tendency is the only factor which is constantly present."

However, since the publication of these reports, cases have been discovered among those listed by these two authors and others in which the hereditary factor could not be demonstrated and yet all the classic signs and symptoms of hereditary hemorrhagic telangiectasia were presented.

Fitz-Hugh,[12] in 1923, in a comprehensive study of thirty families already recorded in the literature, was the first to call attention to the existence of patients manifesting the disease in classic form from whom a characteristic family history could not be elicited. He explained this on the basis of atavism, or " 'skipped generations' in the inheritance of this disease."

His observations on this subject are so illuminating that the following excerpt will bear repetition:

> There had been reported a number of isolated, apparently non-hereditary cases which conform so closely to the disease under consideration that one is forced to class them in the same group. . . . Analysis of the reports in the literature seems to justify that atavism has been overlooked as a factor in the heredity of this disease. . . . I find seven clear instances of atavism in four of the thirty families reported as exhibiting the disease in classical form. . . . The absence of characteristic family history does not exclude the possibility of this disease.

Figi and Watkins [13] in 1943 reported 20 cases collected over a period of twenty years at the Mayo Clinic, in which 6 lacked a positive family history. The authors have included these 6 cases in the category of hereditary hemorrhagic telangiectasia, with the following statement: "From personal observations we are convinced that the clinical history and findings are often sufficiently clearcut to permit of positive recognition in the absence of known familial involvement."

Parkes Weber,[14] in reporting his case, stated, "This is a case of hemorrhagic telangiectasia of the skin and mucous membranes of the Osler type, first manifesting itself when the patient was about 60 years of age—apparently the only case in the family."

It appears from the foregoing that recent observers have recognized and included in the category of hemorrhagic hereditary telangiectasia

12. Fitz-Hugh, T., Jr.: The Importance of Atavism in the Diagnosis of Hereditary Hemorrhagic Telangiectasia, Am. J. M. Sc. **166**:884 (Dec.) 1923.

13. Figi, F. A., and Watkins, C. H.: Hereditary Hemorrhagic Telangiectasia, Ann. Otol., Rhin. & Laryng. **52**:330 (June) 1943.

14. Weber, F. P.: Hemorrhagic Telangiectasis of the Osler Type, Brit. J. Dermat. **48**:182 (April) 1936.

the occasional case which demonstrates the classic telangiectasis and bleeding in the absence of the hereditary factor.

Further, the disease is not sex linked, men and women are affected alike and the two are equally capable of transmitting the disease to their offspring.

### TELANGIECTATIC AREAS, TYPICALLY DISTRIBUTED

Telangiectasis may occur on any of the mucous membranes or anywhere on the external surface of the body. The trunk and limbs, except the finger tips and nail beds, appear to be the least involved. The nasal mucosa is seemingly oftenest affected, followed by the tongue, palate, lips, mucocutaneous junction, buccal area, gum, pharynx, conjunctiva and sometimes the larynx, stomach, colon, bladder and brain. On the skin, these lesions are more commonly found on the cheeks, nasal orifices, ears, scalp, neck, finger tips and nail bed.

The telangiectases are said to begin as dilatations of the capillaries, having a bright red color. As these areas increase in size, the venules participate in the ectasia, giving the cutaneous telangiectases a violaceous or purple color. The telangiectases of the mucous membrane are always a brilliant red.

The lesions are oftenest described as small red or purple spots, usually of pinpoint size, though sometimes larger, and, even in certain instances, of spider-like configuration, which are most prone to appear on the face. Steiner [8] mentioned a third variety, "the nodular type, which may originate in the center of a spider angioma and finally form a solid vascular tumor, split pea in size."

They usually disappear on pressure and regain their color when the pressure is removed, obviously true vascular formations and not blood extravasations. Sometimes they come and go in crops, without apparent reason. One must bear in mind that practically every one has telangiectatic areas on some parts of the body, which usually escape detection because they produce no symptoms.

They may be seen early in life. Hanes [11] observed them as early as 8 years of age in a boy, but generally if present at such an age they are not especially numerous, for they do not attain their full number until after the age of 35.

Hanes [11] theorized that "Repeated traumatisms certainly seem to play a part in the production of telangiectases. The ears, the cheeks, the muco-cutaneous junction of the lips, the nasal and buccal mucous membranes, the finger tips—these are the sites of predilection and these are obviously the points most subject to frequent slight traumatisms."

However, he gave a more specific instance, in which 1 of his patients "had the misfortune to run a large splinter under a finger nail, and the consequent suppuration caused the nail to come away. Eventually,

a new nail grew, and under it two large telangiectases were observed to have formed. These bled so readily and profusely upon slight injury to the nail that the man's work has been seriously hampered. He is compelled to wear a leather cot on the finger constantly."

Larrabee and Littman [15] appear to be in accord with this view of the lesions' being most abundant at points most subject to repeated slight trauma, a finding observed in all their cases.

Meikle [16] has also made a similar observation, and in the last paragraph of his comment he stated: "The fact that the patient's mother did not exhibit telangiectases on her palate under her dental plate, but did so on the unprotected parts of the palate, lends some slight support to Hanes' belief that repeated small traumata are an etiological factor."

### TENDENCY OF THE TELANGIECTATIC LESIONS TO BLEED

The hemorrhages always originate in the telangiectatic areas when they are present, except during the period of childhood, when bleeding (usually epistaxis) appears without the apparent presence of telangiectasis. The bleeding is oftener steady and regular than sudden and spurting, appearing at the most superficial point of the telangiectasis.

Epistaxis [17] is the type of bleeding seen in practically all the cases, and, in fact, it is this symptom which usually calls attention to the disease. Hemorrhages are always on the surface and never into the tissues of the mucous membranes and skin.

Hemorrhages of the gum and buccal mucosal bleeding occur less frequently than hemorrhages of the lips and tongue in the group of oral hemorrhages. Gastrointestinal and genitourinary hemorrhages and bleeding into the central nervous system have been reported in varying numbers, while bleeding from the finger tips, scalp, ears and other parts of the body has been noted also.

The bleeding may be alarmingly profuse and may in some instances cause death. Phillips [4] reported the only death I have been able to find from gum hemorrhages but gave no detailed report. Fitz-hugh [12] reported 4 per cent deaths from epistaxis in families previously reported. Houser [18] reported three deaths from epistaxis in seven families, a death rate of 27.2 per cent.

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15. Larrabee, R. C., and Littman, D.: Hereditary Hemorrhagic Telangiectasia, New England J. Med. **207**:1177 (Dec. 26) 1932.

16. Meikle, G. J.: A Case of Hereditary Telangiectasia, Lancet **2**:863 (Oct. 14) 1933.

17. Since epistaxis is the preponderant symptom in this disease and gingival hemorrhage has been mentioned little in the literature up to now, it is of necessity that I refer to epistaxis so often in order to round out this paper.

18. Houser, K. M.: Hereditary Hemorrhagic Telangiectasia, Ann. Otol., Rhin. & Laryng. **43**:731 (Sept.) 1934.

Hanes [11] and Parkes Weber [14] called attention to the vicious cycle resulting from repeated hemorrhages, which produce a grave secondary anemia, and this in turn increases the tendency to bleed.

In some cases, the small repeated hemorrhages are the only symptoms for years, the cutaneous and mucosal phenomena appearing later in life. In other cases there may be typical hereditary, cutaneous and mucosal lesions which never bleed.

Trauma is not necessary, for bleeding occurs spontaneously, without injury or irritation. Some patients have nasal or oral hemorrhages three or four times daily for weeks at a time. Most patients suffer repeatedly from more or less violent hemorrhages, leading to secondary anemia. Fatal hemoptysis, hematemesis and metrorrhagia have also been reported.

The onset of hemorrhage is generally in early childhood, usually before any telangiectases have been recognized, but the attacks become more prolonged as the patients advance in years, the period between 35 and 38 years being the time when the increase is especially noted.

Fitz-Hugh [12] supported the mechanistic hypothesis of the hemorrhages, concluding "that the hemorrhages are the result of rupture of the thin-walled, superficial vascular defects that characterize the disease. This rupture may be brought about in a variety of ways—slight traumatism, insignificant irritations, vasomotor or mechanical congestion. It is suggestive that eight patients are recorded as awaking frequently at night to find the pillow wet with blood from epistaxis. The intranasal congestion, which probably occurs during sleep, doubtless determined telangiectatic rupture in such instances."

Hurst and Plummer [19] listed additional factors which may determine the onset of hemorrhage, as lying down, being exposed to heat of a furnace and drying the face with a towel after washing.

Hanes [11] recorded the abuse of alcohol as a contributing factor in provoking hemorrhages and attributed it to the vasodilator action of alcohol on the peripheral capillaries.

### HISTOPATHOLOGY

The histopathology of the lesions in hereditary hemorrhagic telangiectasia has been described by Hanes,[11] Gjessing,[20] Arrak [21] and others.

19. Hurst, A. F., and Plummer, N. S.: Hereditary Telangiectasia with Hemorrhagic Tendency, Guy's Hosp. Rep. **82**:81 (Jan.) 1932.

20. Gjessing, E.: Telangiectasia hereditaria haemorrhagica (Osler), Dermat. Ztschr. **23**:196, 1916.

21. Arrak, A.: Hereditary Hemorrhagic Telangiectases, Deutsches Arch. f. klin. Med. **147**:287, 1925.

Hanes's [11] excellent description of his microscopic studies of a telangiectatic area removed from the cheek of 1 of his patients follows:

> The obliteration of the papillae of the corium, together with the absence of the usual undulations of the stratum germinativum, is very striking. This is doubtless due to the relatively enormous dilatation of the blood vessels of the corium which are seen as wide spaces lined by a single layer of endothelium lying immediately subadjacent to the greatly attenuated epidermis. These dilated vessels can be traced well down into the subcutaneous fatty tissue. A study of sections stained by various special methods failed to reveal any muscular or elastic tissue in the walls of the dilated superficial vessels, although the less dilated vessels in the subcutaneous fatty tissue show the normal arrangement of the tunicae.
>
> When one notes the very scanty protection afforded the dilated vessels by the thin epidermis, it is no longer surprising that trivial traumatism produces marked hemorrhage.

Apparently, the lack of elastic tissue in the dilated vessels may be responsible for the hemorrhage, which once started continues unabated, undoubtedly because of the inability of these walls to contract.

### ASSOCIATED PATHOLOGY

Fitz-Hugh [22] and others have observed an associated enlargement of the liver and spleen, particularly in patients who have been suffering from repeated and prolonged hemorrhages. An intolerance to blood transfusions in these patients has been noted, especially those in the group with blood of type 4 (Moss).

### LABORATORY AND IMPORTANT NEGATIVE FINDINGS

All the blood studies in hereditary hemorrhagic telangiectasia have been reported as being normal except for a secondary anemia, which may occur in cases of severe chronic bleeding.

Purpura has never been found in this condition.

Vascular fragility, as demonstrated by the tourniquet test or the Rumpel-Leeds method, has been reported normal. However, Singer and Wolfson,[23] in their summary, stated: "A family presenting hereditary hemorrhagic telangiectasia, together with a positive tourniquet test, is described."

### DIAGNOSIS

The diagnosis of hereditary hemorrhagic telangiectasis is based usually on (*a*) a history of heredity,[24] not sex linked, (*b*) charac-

22. Fitz-Hugh, T., Jr.: Splenomegaly and Hepatic Enlargement in Hereditary Hemorrhagic Telangiectasia, Am. J. M. Sc. **181**:261 (Feb.) 1931.

23. Singer, K., and Wolfson, W. O.: Hereditary Hemorrhagic Telangiectasia: An Analysis of Capillary Heredopathies, New England J. Med. **230**:637 (May 25) 1944.

24. The absence of characteristic family history does not exclude the possibility of this disease.

teristic telangiectasis, typically distributed, and (*c*) tendency of these areas to bleed.

### DIFFERENTIAL DIAGNOSIS

*Scurvy.*—There is usually a history of dietary indiscretion, with symptoms of swollen, spongy, ulcerated gums, which bleed freely to the slightest touch. Mastication is painful. Petechiae and ecchymotic areas in the skin of the lower extremities are pronounced. The condition responds readily to vitamin C therapy.

*Acute Leukemia.*—Usually there is a history of rapid onset of irregular fever and pallor, with ulcerative inflammation of mouth, gums or tonsil and hemorrhages from the mucous membranes. Blood smears showing a preponderance of immature white blood cells usually establish the diagnosis.

*Purpura Hemorrhagica.*—There is a history of repeated attacks of hemorrhage associated with petechiae and ecchymotic areas over the body and extremities. The number of blood platelets is decreased, bleeding time is prolonged, coagulation time is usually normal and there is delayed clot retraction time.

*Hemophilia.*—Hemophilia is confined to the male sex and is transmitted by women. Bleeding is provoked by the slightest injury and usually from the normal skin. There are painful hemorrhages into the joints. The platelet count, bleeding time and blood clot retraction time are normal. Prolonged coagulation time is the characteristic finding.

### PROGNOSIS

The condition progresses throughout life, with no tendency toward spontaneous involution. It may be benign and the patient hardly aware of its existence, but it may have a fatal ending due to hemorrhage or concomitant secondary anemia. Controlling the hemorrhage at one point does not necessarily mean that the patient is cured, as active bleeding may occur at some subsequent time from telangiectases in the adjacent mucosa or in areas well removed from the original hemorrhage.

### TREATMENT

There is no known specific treatment for this condition. This is a disease of the blood vessels and not of the blood, and therefore the most logical approach is directed toward checking the bleeding local point when this area is accessible.

The treatment of gingival hemorrhage per se in hereditary hemorrhagic telangiectasia is lacking in the literature, as the treatment up to the present time has been confined to epistaxis, which usually is the presenting symptom in this malady. However, since the reported methods of treatment of epistaxis can just as well be applied to gingival

hemorrhage, a few of the methods successfully reported by various authors are listed.

O'Kane [25] injected a 5 per cent solution of quinine and ethyl carbamate into the adjacent anesthetized septal mucosa, eventually controlling the epistaxis, approximately sixteen injections being used over a period of eighteen months. No sloughing of the mucosa was reported.

Biegeleisen [26] used a 30 per cent solution of sodium chloride for the treatment of a large telangiectasis, with success.

Houser,[18] Steiner,[8] Hanes [11] and others have employed a bead of chromic acid, with success. Figi and Watkins [18] recommended electrocoagulation. Favorable reports were noted with radium by Sterman and Scal.[27] In his conclusions, Stock [10] "observed good results in the single patient who was treated with roentgen rays by the 'intermediate' method."

Peck and Rosenthal [28] have used injections of moccasin snake venom with successful results in 4 cases of "multiple hereditary telangiectasis" with epistaxis but remarked, "In these cases bleeding was controlled as long as treatment was continued, but maintenance doses were necessary to continue control.

Sylnasol,[29] a fibrous tissue proliferant and sclerosing agent, has been successfully used by submucosal injections in certain types of chronic obstructive rhinitis for reduction of the size of turbinal tissues by Thacker,[30] Fox [31] and others.

Thacker [30] made histologic studies of mucosal tissues before and after injection with sclerosing agents submucosally and reported that there was a profuse fibrosis throughout the tunica propria, small round cell infiltration and reduction in the number of vascular sinuses. There was no gross or microscopic evidence of atrophy of the tissues even after eighteen months.

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25. O'Kane, G. H.: Hereditary Multiple Telangiectasis with Epistaxis: Method of Treatment, J. A. M. A. **111**:242 (July 16) 1938.

26. Biegeleisen, H. I.: Telangiectasis of the Nose: Treatment by Microinjection of Sclerosive Fluid, Ann. Otol., Rhin. & Laryng. **45**:416 (June) 1936.

27. Sterman, M. M., and Scal, J. C.: Familial Telangiectasia with Recurring Epistaxis Successfully Treated with Radium, New York State J. Med. **37**:287 (Feb. 1) 1937.

28. Peck, S. M., and Rosenthal, N.: Effect of Moccasin Snake Venom in Hemorrhagic Conditions, J. A. M. A. **104**:1066 (March 30) 1935.

29. Sylnasol is a product of G. D. Searle & Co., Chicago.

30. Thacker, E. A.: Value of Fatty Acid Derivatives in the Treatment of Chronic Obstructive Rhinitis, Arch. Otolaryng. **36**:336 (Sept.) 1942.

31. Fox, S. L.: Chronic Vasomotor Rhinitis: A Clinical Investigation of Its Treatment with a Sclerosing Agent, Laryngoscope **53**:759 (Dec.) 1943.

Fox [31] recorded his observations following the submucosal injection of Sylnasol as follows: "In from three to five days the reaction begins to subside, and in from seven to ten days actual shrinkage can be observed. This process continues for some five to six weeks."

The success I have had with the submucosal injection of Sylnasol in a group of select cases of chronic obstructive rhinitis prompted me to use this sclerosing agent submucosally in the gingival area when other methods had failed to control the hemorrhage in the case I am reporting. My chief concern was a possible slough at the sites of injection, but none occurred.

*Vitamin P.*—Szent-Györgyi [32] and a group of his collaborators in 1936 reported on the beneficial effects of an extract of lemon peel in a number of patients with vascular purpura who had not been affected by large doses of pure ascorbic acid. Subsequent fractionation of these extracts tended to reveal that the physiologically active substance consisted of flavone or flavonal glucosides. Szent-Györgyi named the mixture of these "citrin." Owing to the vitamin-like action of these substances, the term "vitamin P" was provisionally used by Szent-Györgyi because of its favorable influence on the pathologic permeability of the capillaries and fragility of the capillary walls (the ease with which capillary walls burst as a result of the application of positive or negative pressures).

Scarborough [33] in 1939 reported 2 cases of vitamin P deficiency in human beings presenting petechial hemorrhages in the skin, with pronounced decrease in capillary resistance. Administration of vitamin P increased the capillary resistance and controlled the tendency to bleed.

Dr. Ben Bryant,[34] one of my department colleagues, was acquainted with the studies on vitamin P in restoring pathologically increased capillary permeability and capillary fragility through his discussions with Mr. A. J. Lorenz [35] and through Goldfarb's [36] work. With Dr.

32. Armentano, L., and others: Ueber den Einfluss von Substanzen der Flavongruppe auf die Permeabilität der Kapillaren, Deutsche med. Wchnschr. **62**:1325, 1936.

33. Scarborough, H.: Deficiency of Vitamin C and Vitamin P in Man, Lancet **2**:644 (Nov. 23) 1940.

34. Dr. Ben Bryant suggested the use of vitamin P and the place where it could be obtained, during a Good Hope Departmental Seminar, Dec. 15, 1941, while the treatment of the patient in the case presented was under discussion.

35. Mr. A. J. Lorenz is the Director of Nutrition Research of the California Fruit Growers Exchange, Los Angeles. An unlimited quantity of "vitamin P lemonade" was placed at our disposal by Mr. Lorenz for the treatment of the patient reported in this paper.

36. Goldfarb, A. E.: Treatment of Psoriasis with Lemon Citrin (Vitamin P), Citrin Lemonade and Ascorbic Acid, Arch. Dermat. & Syph. **43**:536 (March) 1941.

Bryant's cooperation, we obtained from the California Fruit Growers Exchange a large quantity of crude vitamin P in the form of an aqueous lemon peel extract known as "vitamin P lemonade." [36]

## REPORT OF A CASE [37]

J. R. W., a 67 year old man, was admitted to the Ear, Nose and Throat Department of the Good Hope Clinic, with symptoms of deafness (bilateral), a sense of imbalance and headaches, and was assigned to the service of Dr. Fred H. Linthicum on Feb. 13, 1940.

On February 27 Dr. Linthicum carried out vestibular tests, treated both sphenopalatine ganglions with 20 per cent silver nitrate and prescribed orally, with his meals, 1,000 units (3 mg.) of thiamine hydrochloride and 25 mg. of nicotinic acid for his vertigo, which was of the so-called vasoconstrictor type. The patient did not return to the clinic again until October 20, eight months later, at which time Dr. Linthicum advised another course of nicotinic acid and thiamine hydrochloride. I treated the patient occasionally, in the absence of Dr. Linthicum, and continued with his prescribed regimen.

On July 8, 1941 (approximately one and one-half years subsequent to the institution of his oral medication), the patient reported to my morning clinic, holding a blood-stained handkerchief to his mouth. He stated that he had been awakened the night before with a profuse bleeding from his gums. He had lost enough blood to soil two bath towels before he finally checked the hemorrhage by applying cold compresses to the bleeding area.

On examination I found an extensive erosion of the gingival margin bordering the upper left central incisor and the middle third of the upper left lateral incisor teeth (fig. 1 *A*),[38] accumulated debris and coagulum (fig. 1 *B*) and fresh blood clot from recent hemorrhage (fig. 1 *C*) lodged between the upper left central and lateral incisor teeth. There was no bleeding from this area when I started the examination, and it appeared quite innocent. However, a mere touch with a cotton-tipped applicator to remove some of the adherent debris and blood clots produced a sharp gush of blood. After considerable difficulty, the hemorrhage was finally brought under control with a bead of silver nitrate and pressure.

A detailed examination of the mouth revealed the following conditions: There was an extensive pyorrhea, with definite evidence of lack of oral hygiene; two small brilliant red telangiectatic spots were visible high up on the hard palate; several smaller ones were noted in the oropharynx; one large telangiectatic area was noted in the mucosa of the left upper second molar region (fig. 6 *A*); the floor of the mouth (fig. 5 *A* and *B*) revealed a cluster of nodular angiomas grouped around the opening of the right Wharton duct, near the frenum, and several angiomas were grouped along the course of the left duct; one small pink telangiectasis was present in the mucosa of the lower lip, and several violaceous-colored telangiectatic spots were visible on the right cheek (fig. 4 *A* and *C*). No telangiectatic areas were visible on the nasal mucosa.

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37. The data appearing in this case report was obtained from the patient's record in the files of the Good Hope Clinic, Los Angeles. The quotations are verbatim transcriptions of my dictated progress reports.

38. This photograph (fig. 1) was taken on Nov. 22, 1941, more than four months subsequent to the onset of the initial hemorrhage from this area, but it appears practically identical to the lesion as I observed it on the morning of July 8, 1941, a few hours after the initial hemorrhage.

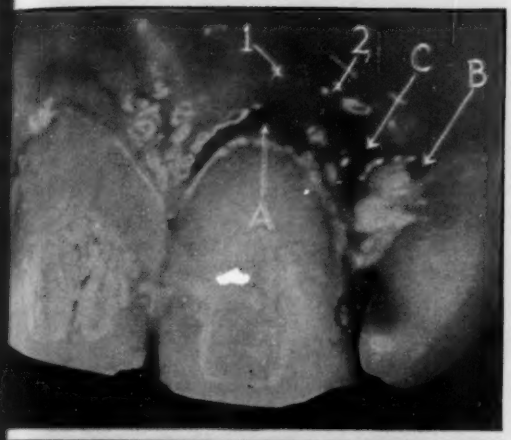


Fig. 1.—Site of bleeding, taken Nov. 22, 1941, immediately after a profuse hemorrhage had been controlled with a chromic acid bead. (The initial hemorrhage from this site occurred on July 8, 1941.) *A*, ulcerated gingival margin, from which hemorrhages were occurring, bordering the base of the upper left central incisor and the middle third of the upper left lateral incisor. *B*, accumulated debris and coagulum lodged between the teeth. *C*, fresh blood clot from recent hemorrhage, lodged between the teeth. *1*, site of first injection of Sylnasol, on Feb. 5, 1942. *2*, site of second injection of Sylnasol, on Feb. 12, 1942.

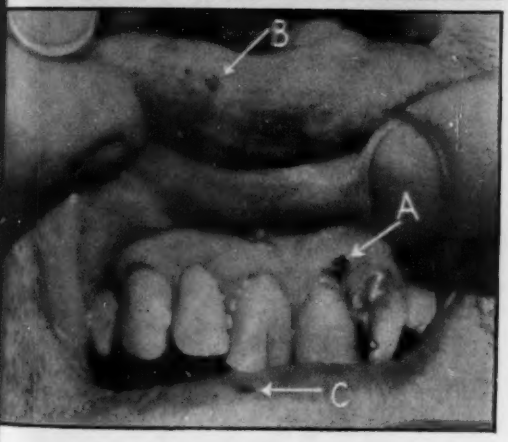


Fig. 3.—Site of original lesion, taken on Feb. 2, 1945, approximately three years after the injections with the sclerosing solution Sylnasol. *A*, a relatively large telangiectatic area present in the region of the original gingival ulceration. This, no doubt, is the spot from which the bleeding occurred initially. *B*, a small telangiectatic area in the mucosa of the upper lip. *C*, a small telangiectatic area in the mucosa of the lower lip.

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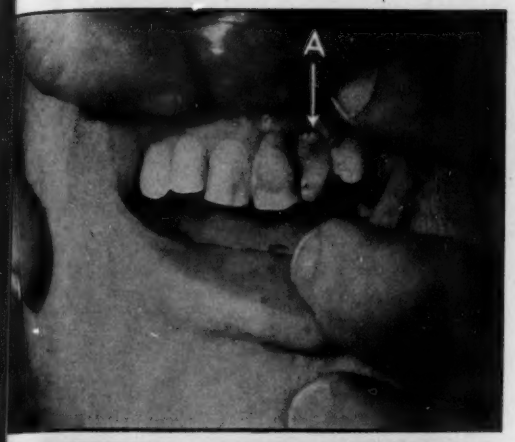


Fig. 2.—Condition on March 5, 1942, approximately one month subsequent to the injection of the sclerosing solution Sylnasol. *A*, the gingival border is well healed, showing some recession but no evidence of damage to the gingival tissues. The area, however, still appears edematous and swollen.

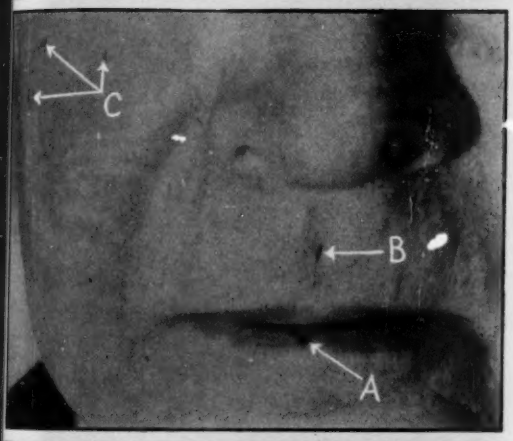


Fig. 4.—View of the face, taken Feb. 2, 1945. *A*, a small telangiectatic area in the mucosa of the lower lip. *B*, a small telangiectatic area in the skin of the upper lip. *C*, several small telangiectatic areas over the right cheek.

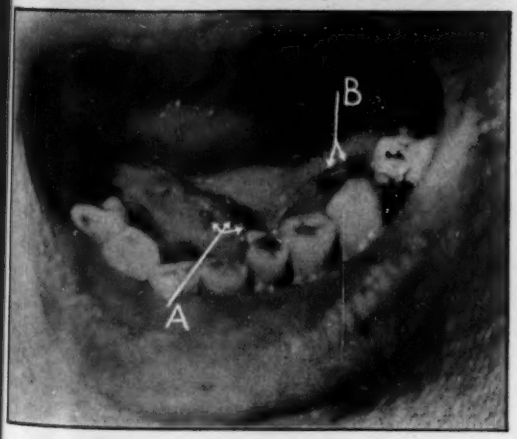


Fig. 5.—View of the floor of the mouth, taken Feb. 2, 1945. Nodular angiomas appear concentrated along the course of Wharton's ducts. *A*, a cluster of nodular angiomas grouped around the opening of the right duct, near the frenum. *B*, several angiomas along the course of the left duct.

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Up to this time, these telangiectatic areas and angiomas were of little significance to me. However, with the onset of this alarming hemorrhage, which I found difficult to control, and the presence of the many telangiectatic areas, I was reminded of a case of Osler's disease (the only one I had ever seen up to this time), which I had observed on the service of Dr. Samuel J. Pearlman, while serving my residency in the Department of Otolaryngology at Cook County Hospital, Chicago. Accordingly, a tentative diagnosis of Osler's disease was entered on the patient's record at this time, and he was referred to the department of oral surgery for consultation.

On July 21, 1941; two weeks later, he reported a profuse hemorrhage from the area of the gum one week previously and also similar but smaller attacks since. All these he was able to control with cold compresses and pressure. When questioned as to a familial bleeding tendency, he stated that he had no knowledge of any unusual bleeding in any of his relatives. However, in checking into his family history, he recalled that one of his brothers had had profuse spells of bleeding from his stomach and bowel at irregular intervals for a period of ten years previous to his death (he died at the age of 64). His condition had been diagnosed as "stomach ulcers," and at autopsy the diagnosis of ulcer of the stomach was, according to the necropsy report (patient's statement), verified.

Two important facts in the patient's past history were disclosed in this interview:

1. In 1933 he had had several minor hemorrhages from his bowel. In the fall of 1934 he suffered with repeated hemorrhages from the bowel, and in 1935 these hemorrhages had become so numerous and debilitating that an exploratory abdominal operation was performed but the cause could not be found. All the laboratory tests and physical examinations were noncontributory, to his knowledge.

2. About three years before I saw him he had numerous attacks of nosebleed from his left nostril, which were not extremely severe and which he was able to control by plugging the affected side with tissue paper. Both of these conditions apparently cleared up spontaneously.

The patient was referred at that time to the department of internal medicine for consultation and further work-up. The tentative diagnosis of Osler's disease (hemorrhagic telangiectasis) was still entertained, pending a complete hematologic report.

The course of this condition was one of repeated hemorrhages from the gingival lesion, occurring at irregular intervals, usually when he attempted to eat and, frequently, spontaneously during his sleep. The longest period of quiescence lasted about three or four days. Sometimes the hemorrhages occurred daily, once, twice or even three times. At other periods, several days would elapse before one was provoked.

Vitamin K combined with bile salts as well as large doses of vitamin C (500 mg. daily) was prescribed orally, but apparently none of these had any effect on the bleeding.

On Sept. 26, 1941, Dr. H. B. Cates, medical consultant, reported as follows:

"All laboratory work ordered [listed in the tabulation] is well within normal limits. The patient apparently does not have a hemorrhagic diathesis. However, telangiectasis has not been ruled out. Further studies are suggested. Take nicotinic acid, 50 mg. three times a day. Return to the ear, nose and throat clinic."

Following are the laboratory reports.

| | |
|---|---|
| Platelet count | 200,000 (appear normal) |
| Bleeding time | 2½ minutes |
| Coagulation time | 3 minutes |
| Prothrombin time | 14 seconds (control 13 seconds) |
| Hemoglobin | 87% |
| Red blood corpuscles | 3,800,000 |
| Color index | 0.92 |
| White blood corpuscles | 6,400 |
| Differential white cell count | |
| Polymorphonuclears | 74% |
| Eosinophils | 1.5% |
| Lymphocytes | 22.5% |
| Monocytes | 2% |
| Vitamin C content | 1.4 mg. per 100 cc. plasma (normal 0.8 to 2.4 mg.) |
| Clot retraction time | Normal |

Subsequently, during each biweekly visit to the clinic, the gingival lesion was touched up with a bead of chromic acid, as recommended by Hanes,[11] the application of which produced a profuse hemorrhage at first but finally brought the bleeding under control when the caustic action took effect. This effect was usually short lived, as the patient would eventually have to resort to the cold compresses and pressure at home.

On Dec. 15, 1941, the further treatment of this patient was brought up for discussion at the Good Hope Clinic Department Seminar. Dr. Ben Bryant suggested the use of vitamin P lemonade as an agent to control this type of vascular hemorrhage. On Dec. 30, 1941, the patient was instructed to take orally 2 ounces (60 cc.) three times daily, estimated to contain 300 mg. of vitamin P.

On Jan. 8, 1942, one week later, I examined the patient and dictated the following report for his record: "The patient has not had any bleeding to amount to anything from the gum area since the institution of the vitamin P therapy. I was able to probe the area with a cotton applicator without provoking any bleeding. Previously, merely touching of this area would produce a sharp hemorrhage. The ulcerated area looks clean and appears to be resolving and healing. The patient is now able to chew on the left side without any bleeding. The dilated vessels on the floor of the mouth are not so pronounced at this examination."

On January 15, he reported that he had had no bleeding since the administration of the vitamin P two weeks previously. The ulceration of the gum line appeared to be healing, and probing with a cotton applicator failed to elicit any signs of bleeding.

On January 29 he related this story: Three days before, his supply of vitamin P had become depleted, and since he was doing so well he decided to wait until his regular clinic visiting day (that day) to get more. However, early that morning, the bleeding started anew and actively.

Cleansing the area with a cotton applicator started a profuse hemorrhage. This was controlled with a bead of chromic acid. Vitamin P lemonade therapy was again started.

On February 5 he reported having had a severe bleeding attack the preceding day while dining and also having bled on the pillow the night before. There was no bleeding while I examined him. I gave him his first injection of sclerosing solution, Sylnasol, at this sitting as follows:

A small cotton pack saturated with tetracaine hydrochloride solution, 2 per cent, was placed between the affected area of the gum and the lip and left in place for approximately ten minutes. A short, beveled, 26 gage needle being used, 0.2 cc. of Sylnasol was introduced into the submucosa of the gingival area, as indicated in figure 1 at site *1*. There was an immediate blanching of the tissues, spreading over an area of approximately ⅜ inch (9 mm.), followed by a sudden sensation of

pain, extending up the left side of the patient's face to the left eye and producing an active lacrimation from this eye. This painful sensation lasted about three minutes and was then replaced by a dull, aching pain which was not unbearable. Following the injection, the bleeding became profuse for a short time, but this was controlled with pressure.

The patient was advised to continue taking the vitamin P lemonade as before. However, on this day the administration of nicotinic acid was discontinued.[39]

On February 12 the injected area appeared blanched out, but the gingival erosion lateral to the injected area appeared red and may have been responsible for the hemorrhage which the patient stated occurred the night previously. This was the only hemorrhage which the patient had experienced, occurring five days subsequent to the injection of Sylnasol, but it was moderate in character.

The same technic as described being used, another 0.2 cc. of Sylnasol was injected in the gingival area, submucosally, at the spot indicated in figure 1 at site *2*. The patient experienced the same painful sensation of the left side of the face, and lacrimation of the left eye. Blanching again occurred at the site of injection.

On February 19 the patient reported a minimal amount of bleeding since the last injection, one week before. The injected area revealed a pronounced recession of the gum, and there was then visible a small red area [40] in the region of the medial third of the initial gingival erosion. Since the last injection, the patient had had pronounced tenderness of the upper and lower jaws on the left side, making it almost impossible for him to chew solid foods. However, in the last day or two, he had been able to eat soft foods with comfort. This reaction was, in all probability, an aftermath of the injection of the sclerosing solution.

On March 19 the patient stated that he had had no bleeding from the gum area for the past three weeks. I was able to cleanse the debris from the gingival margin with a cotton applicator without provoking a hemorrhage. The gingival margin had receded but there was no evidence of sloughing of the injected tissues (fig. 2). A bromsulfalein test for hepatic function taken on this day was reported negative.

On June 4, 1942 vitamin P therapy was discontinued. The gingival margin appeared healed. The small telangiectatic area which had been just visible in the swollen gingival margin on February 19 was pronounced and larger. It was a deep red and was approximately 2 mm. in diameter.

## SUBSEQUENT EXAMINATION AND INTERIM HISTORY

On Feb. 2, 1945, the patient visited my office for a check-up. I obtained several photographs of the various lesions and at the same time recorded some pertinent history data. There had been no bleeding from the gum area since March 1, 1942, and he had not taken any medicament for its control during this interval.

On March 19, 1943, the patient had had a transurethral resection of the prostate performed, following which he remained in the hospital for ten days, with no unusual bleeding. He was sent home on the tenth day, but that night, while forcibly attempting to move his bowels, he began to bleed from the urethra and

39. This was the first time that the nicotinic acid therapy was stopped. The discussion of my views on this product will be found under "Comment."

40. This small red area was no doubt the original telangiectasis from which the hemorrhage occurred and was visible now that the mucous membrane was returning to normal and the original ulceration and edema had subsided. Figure 1 *b* shows this telangiectatic area clearly.

went back to the hospital. The bleeding was controlled in about three days, and after another two weeks in the hospital he was sent home, with no further recurrence. He was told that this postoperative bleeding was not unusual in this type of work.

His previous surgical history includes an appendectomy forty years ago, a tonsillectomy in 1928 and an exploratory laparotomy in 1935, as mentioned in the history of the case. In 1943 two molars were extracted, without any unusual amount of subsequent bleeding.

This seems to bear out the statement of previous observers that operation and extraction of teeth produce no more bleeding in this condition than in normal persons.

The tourniquet test for capillary fragility was noncontributory.

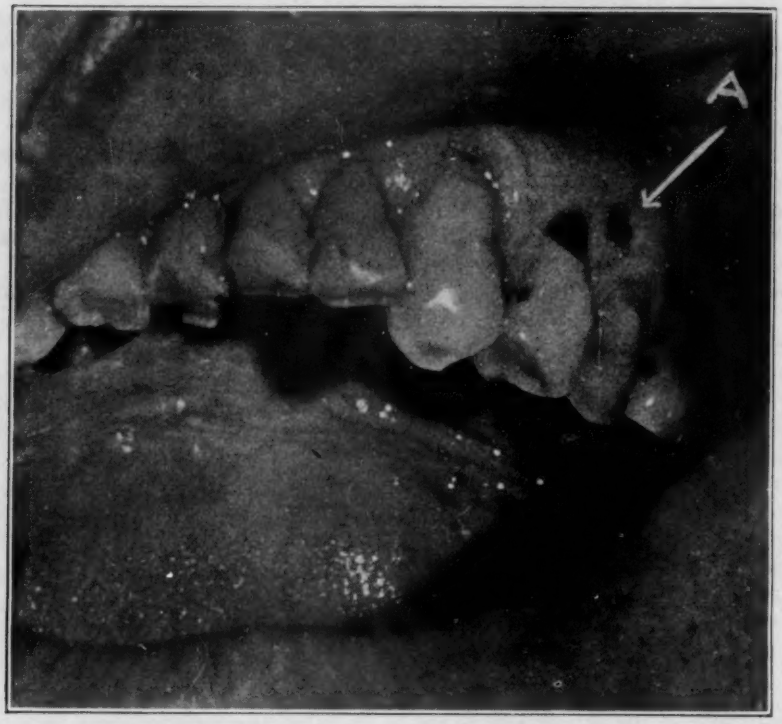


Fig. 6.—View of the left upper molar region, taken April 13, 1943. *A*, a relatively large telangiectatic area in the mucous membrane between the first and second upper left molars.

The photographs taken on Feb. 2, 1945 bear some comment. Figure 3 *A*, reveals a large brilliant red telangiectatic area in the region of the original ulcerative process and no doubt is the spot from which the initial hemorrhage started. This is the same area which I observed in my progress notes of Feb. 19, 1942, and June 4, 1942, at which time it came into view as the gingival ulceration and edema subsided. It is worthy of note that the sclerosing agent had not destroyed this telangiectasis.

The telangiectatic area in the mucosa of the upper lip (fig. 3*B*) is new and has not appeared in my previous photographs. The telangiectasis in the cleft of the upper lip (fig. 4*B*) is also new and is of recent origin. The large telangiectatic area in the upper molar area, as depicted in the photograph taken April 13, 1943 (fig. 6*A*), could not be found when I examined the patient on Feb. 2, 1945. This apparently bears out the observation of previous authors that these areas come and go for no obvious cause.

## COMMENT AND CONCLUSIONS

This male patient demonstrates the classic telangiectasis, distributed about the mouth and face, with gingival hemorrhage first manifesting itself at the age of 67. His is apparently the only case in the family and therefore may be classified as the atavistic type of hereditary hemorrhagic telangiectasia (Fitz-Hugh [12]). Except for the type of bleeding, this case appears similar in many respects to that described by Parkes Weber.[14]

In my search of the literature, I have failed to find a detailed and illustrated report of a case of gingival hemorrhage and oral manifestations in this malady.

The use of vitamin K with bile salts and large doses of vitamin C orally proved of no avail in the control of this hemorrhage. Topical application with the silver nitrate bead first and the chromic acid bead later stopped the bleeding temporarily, but the subsequent pressure and cold compresses by the patient were necessary for control of the hemorrhage.

The role of nicotinic acid in this case is interesting and deserving of comment. Nicotinic acid, in contradistinction to its amide (nicotinamide), is a powerful peripheral vasodilator. This patient had ingested 25 mg. of nicotinic acid three times daily for approximately one and one-half years before the initial gingival hemorrhage developed. This vasodilator action on a pathologically thin-walled vascular defect (telangiectasis) situated in a vulnerable spot (fig. 3*A*) and subjected to repeated traumatic insults during chewing of food, could effectively lay the groundwork for this hemorrhage (Fitz-Hugh's [12] mechanistic hypothesis).

Vitamin P lemonade controlled the hemorrhage for approximately four weeks, but as soon as this medication was stopped the bleeding recurred.

Several conclusions may be drawn from the results of this case:

A. Nicotinic acid is definitely contraindicated in this malady, as it puts an added burden on an already dilated, thin-walled, superficial vascular defect (telangiectasis), which may rupture through slight trauma or insignificant irritations.

B. Vitamin P, reportedly of proved value in pathologic capillary permeability, was effective in controlling the hemorrhage for one month

in this case, while the patient was taking nicotinic acid. In this malady, vitamin P may prove of value in the cases in which the hemorrhage is not accessible, namely, gastrointestinal and genitourinary hemorrhage and bleeding from other areas.

C. The sclerosing solution (Sylnasol), effective in arresting the hemorrhage, did not destroy the original telangiectatic area which had initiated the hemorrhage (fig. 3 *A*), and which may start to bleed again at any time in the future.

Another point of interest is the normal blood picture in this disease. Since this disease is one of the blood vessels and not of the blood, a normal blood picture is a relatively constant finding and therefore an important one. For that reason it seems logical to add this predominant finding to the three cardinal findings already postulated for a diagnosis and to read as follows: (*a*) a hereditary tendency to the disease, (*b*) the presence of telangiectatic areas, typically distributed, (*c*) the tendency of these telangiectatic areas to bleed and (*d*) a normal blood picture, except for a concomitant secondary anemia in chronic bleeding.

### SUBSEQUENT HISTORY [41]

On Jan. 5, 1946, the patient noticed some bleeding from his gums following what he termed "careless tooth brushing." This bleeding did not appear important at the time, but in a few days it developed into a continuous ooze.

On January 22 the patient reported to my office, and on examination of his mouth I found a slight oozing from the original telangiectatic area. The lesion at this time was approximately the same size and shape as depicted in figure 3 *A*. I probed the area gently with a cotton-tipped applicator, and there was sudden increase in the bleeding. This, however, was easily controlled with pressure. On this day (January 22), the patient was given 150 tablets of "lemon peel infusion, dry," [42] with instructions to take two of these three times daily.

At the end of two weeks, the patient reported that there had been little if any improvement. On Feb. 7, 1946, the patient contracted influenza and did not take any of the tablets for approximately two weeks, as the bleeding appeared to decrease during his illness.

However, on February 20, the bleeding started anew and became so constant that his mouth seemed always filled with blood, which oozed

41. This part of the history covers the period from Jan. 5, 1946 to July 26, 1946.

42. The tablets of lemon peel infusion are the aqueous extract of fresh lemon peel, containing the various flavone fractions of Szent-Györgyi's original vitamin P. Each 250 mg. tablet is standardized to equivalency of 10 Gm. fresh lemon peel. From Jan. 22, 1946 to July 26, 1946 the patient took the equivalent of 9.4 pounds (4.3 Kg.) of fresh lemon peel.

out in quantities on the slightest pressure and was even aggravated by the movement of his lips in talking. He started taking the vitamin P tablets again, and by the middle of March all the bleeding had stopped.

About April 4 he stopped taking the tablets, and his course continued uneventful until about June 8, when a small amount of oozing followed the use of his toothbrush. He then resumed his tablets, and in his last written report to me, dated July 26, 1946, he stated that his bleeding is entirely under control and the gum is firm and not sensitive at all.

From the foregoing, it appears that we have a preparation which can control the bleeding from the telangiectatic area on his gum.

Dr. Fred H. Linthicum granted me the privilege of presenting this report of a case, Dr. Ben Bryant suggested the use of "vitamin P lemonade" and Mr. A. J. Lorenz supplied the "vitamin P lemonade" which was used.

1930 Wilshire Boulevard.

# NEW TREATMENT FOR HEARING DISORDERS

HANS HIRSCHFELD, M.D.

MAX JACOBSON, M.D.
AND
AUGUSTA JELLINEK, Ph.D.
NEW YORK

IN THIS paper we describe a new treatment for hearing disorders. It consists of a combination of amino acids and vitamins. Quick response and lasting improvement have resulted from the use of this medication.

## PHARMACOLOGIC COMMENT

A year previous to this experiment one of us (Dr. Jacobson) combined amino acids and vitamins in order to increase the effect of the vitamin action.[1]

Before this, amino acids had been used only in hypoproteinemia, shock, postoperative conditions and severe starvation. However, it was found that vitamins in combination with protein and amino acids catalyze many important body reactions (oxidations, reductions), play an important role in many enzymes containing vitamins and facilitate many metabolic transformations as co-enzymes. Northrop,[2] Baumann and Stare[3] and Heidelberger,[4] among others, have reported on these relationships between enzymes, co-enzymes and vitamins.

The medication was applied in two different ways. In the first, 2 cc. ampules containing thiamine, riboflavin, pyridoxine, nicotinamide, choline, glutamic acid, histidine, methionine and urea were used.

In order to assure a stable saturated solution, we first used only a limited number of amino acids. Sodium glutamate was chosen as a source of glutamic acid, which is the only amino acid known to be metabolized by nerve tissue. Histidine is an important complement of nucleic acid and opponent of histamine. Methionine and choline are important for the maintenance of normal function of the liver and protection against damage of the liver.[5] The B complex was chosen

1. Jacobson, M.: Preliminary Report of the Combined Effects of Vitamin B-Complex with Amino Acids, New York State J. Med. **45**:2079-2081, 1945.

2. Northrop, J. H.: Physiol. Rev. **17**:144-152, 1937.

3. Baumann, C. A., and Stare, F. J.: Physiol. Rev. **19**:353-388, 1939.

4. Heidelberger, M., in Visscher, M. B.: Chemistry and Medicine, Minneapolis, University of Minnesota Press, 1940, pp. 139-156.

5. Jacobsohn, M.: Die klinische Bedeutung des Cholins by erhöhtem Blutdruck, Thesis, Berlin, 1925. Rothschild, F., and Jacobsohn, M.: Die Wirkung des Cholins auf die Blutzusammensetzung, Ztschr. f. klin. Med. **105**:417-419, 1927.

because of its functional importance for nerve metabolism. The importance of nicotinic acid and nicotinamide has been investigated by Selfridge,[6] Nodine, Otto and Roberts. Choline, which is now considered a member of the B complex group, has a special importance for the mechanism of nerve activity (Nachmansohn[7]) in addition to its lipotropic effects. It enables the organism to absorb more completely the fat-soluble vitamins and improve the function of the liver. Urea was added to insure rapid and complete absorption of the water-soluble vitamins.

In the second form of treatment, in which the amino acids were administered in capsules, a wider variety of amino acids could be used: vitamin A, thiamine, riboflavin, pyridoxine, ascorbic acid, nicotinamide, calcium pantothenate, cysteine, urea, tyrosine, choline, glutamic acid, liver concentrate and dried yeast. Vitamin A, ascorbic acid, liver concentrate and yeast were added, the latter two in order to furnish all the B complex factors.

Vitamin A contains important regulatory factors for blood pressure and blood distribution which play an important part in acoustic disorders (Kopetzky[8]). The use of thiamine, riboflavin and nicotinic acid was explained in the description of the ampules. In order to increase the lipotropic effect of choline, tyrosine was added in combination with cysteine. Urea was included to guarantee quick absorption and to increase the solubility of the whole combination. Ascorbic acid was added for its influence on the adrenal cortex and for its importance in the maintenance of blood pressure.

During the first two weeks of treatment the patients received 2 cc. intramuscularly three times a week. During the following weeks they received 2 cc. twice a week. Usually a series of twelve injections was given, but for the more resistant conditions a second series was administered after a pause of two weeks. This therapy was supplemented by daily oral administration of three capsules.[9]

## PRELIMINARY OBSERVATIONS

Clinical tests were undertaken by one of us (Dr. Jacobson) in cases of anemia, nervous exhaustion and gastrointestinal disorders (ulcers of

6. Selfridge, G.: Present Status of Vitamins in Relation to Eighth Nerve and Conduction Deafness, Arch. Otolaryng. **34**:125-140 (July) 1941.

7. Nachmansohn, D.: Acetylcholine and the Mechanism of Nerve Activity, Exper. Med. & Surg. **1**:273-277, 1943; Nachmansohn, D.; John, H. M., and Waelsch, H.: Effect of Glutamic Acid on the Formation of Acetylcholine, J. Biol. Chem. **150**:485-486, 1943.

8. Kopetzky, S. J.: Symposium: Progressive Deafness, Laryngoscope **54**: 217-228 (May) 1944.

9. Capsules (trade name "Hyvanol") and solution (trade name "Amvitol") are manufactured by Walker Vitamin Products, Inc., Mount Vernon, N. Y.

the stomach, colitis, malnutrition). Clinical trial was also made of the therapy as supporting treatment in various forms of neurosis. The tests showed that the principal effect of this medication seems to be the restoration of the balance of the autonomic nervous system.[1]

Fatigue preceding or resulting from organic dysfunction is based primarily on constitutional factors and is increased through the additional use of energy to overcome this handicap. Such observations can be made in disturbances of the gastrointestinal tract, of the endocrine apparatus and especially of the sensory organs.

While a patient was being treated (by Dr. Jacobson) with the new compound for gastrointestinal disturbances, she noticed a distinct improvement in her hearing. We decided, therefore, to study the action of the compound on the acoustic function. For this purpose we made frequent audiometric tests on normal and hard of hearing persons while they were under the influence of the treatment and also after completion of the cure.

### APPLIED THERAPY

The combination of vitamins and amino acids was mostly given by intramuscular injections, supplemented with capsules. The combination of capsules and injections was found to be superior to parenteral therapy alone. The capsules proved particularly valuable in the maintenance of the improvement obtained by the injections.

The clinical investigations were carried out in the Hard of Hearing Clinic of the New York Polyclinic Medical School and Hospital, where 53 patients were examined and treated by two of us (Dr. Hirschfeld and A. Jellinek). Thirty-six additional patients were treated privately. Three persons with normal hearing who were subjected to injections also showed strong reactions, namely, definite hyperacusia. They were in a sense controls. All clinical patients were tested in a soundpoof room; the private patients, in a windowless room of the office. They were all tested immediately before the beginning of the treatment and frequently before and after the injection during the period of treatment. In many cases there was an immediate increase in hearing acuity in from fifteen to thirty minutes after the injection. As this fact proved to be of prognostic importance, every new patient was tested immediately before and thirty minutes after the first injection. Thirty of those treated at the hospital showed great improvement; 13 showed some improvement; 10 showed no improvement; 4 failed to continue the treatment. The full effect was usually reached within two to four weeks; continuous treatments over a period of two to three months or more did not seem to present any additional advantages. Some patients who achieved good results within the short period of treatment have kept the original gains (charts 3, 6 and 8). In older persons, however, it is advisable to

continue the treatment with capsules, as an additional vitamin supply is indicated in all organic disorders of old age.

Increase in acoustic perception was notable in the speech range (middle octaves, 512, 1024 and 2048) (charts 1, 2, 9 and 11). The full gain in the hearing capacity of nearly all patients can be rightly evaluated only if the whole tone range is taken into consideration, for the most important gains appear in the high-pitched tones (4096, 8192 and 9747) (charts 3, 4, 6, 10 and 12). Several patients who had not been able to hear the high tones (8192 and 9747) of the audiometer began to hear them after they had had one or two injections (charts 4 and 5). These perceptions, once gained, persisted.

This increase in high tone perception is a definite advantage for the understanding of speech, as the formants of the consonants are mostly high overtones, and therefore discrimination of sounds and understanding of speech depend largely on hearing them. Several of the patients spontaneously reported better understanding of speech or a newly gained ability to hear the ringing of the telephone.[10]

As the loss of high tone perception is currently interpreted as a symptom of nerve degeneration, an improvement of hearing perception in this area seems to indicate a functional improvement of the nerve.[11]

Some patients showed notable gains in hearing in one ear only, while the other ear remained unchanged or showed only slight gains. The reason for that fact is probably that the hearing loss in the ear which did not improve was of longer duration (Kopetzky [8]). This observation seems to preclude a purely psychologic effect of the treatment (chart 3).

Some patients showed improvement in the air conduction audiograms which was followed only at a later date by improvement in bone conduction. In other patients the increase in hearing capacity was greater in bone conduction than in air conduction (chart 8).

We had occasion to observe not only quantitative improvement but, in a case of diplacusis binauralis dysharmonica occurring in a singer, gradual progress toward normal hearing during the treatment. The patient, frequently tested and asked to sing the tones as he heard them, began to hear less divergent sounds on both sides, and many tones were finally heard in equal pitch in both ears. In the beginning he also showed changes in the perception of pitch up to the interval of a fourth if the intensity of the tone changed in the same ear while the pitch remained constant. The latter phenomenon disappeared nearly completely under treatment.

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10. Guilder, R. P.: Audiometric and Word Test Findings: Preliminary Report, Ann. Otol., Rhin. & Laryng. **52**:25-34, 1943.

11. Crowe, S. J.; Guild, S. L., and Polvogt, L. M.: Observations on the Pathology of High Tone Deafness, Bull. Johns Hopkins Hosp. **54**:315, 1934.

The gains in hearing were in some cases impressive—up to 40 or 50 per cent. Gains in threshold perception sometimes reached 40 to 70 decibels for some tones (charts 3, 7 and 12).

The increase in perception of pure tones as recorded on the audiometer does not necessarily register on the patient's consciousness as better understanding. Some of the persons mentioned in the foregoing paragraphs did not themselves acknowledge the progress observed in the audiograms. In such cases, psychologic measures, such as acoustic training, are needed to bridge this gap. Other patients reported a notable subjective increase in hearing as soon as the audiometric record showed progress of 10 decibels or more.[12]

In the previous attempts to treat patients for acoustic disorders with vitamins results were mostly obtained with nicotinic acid and vitamin A but, especially in the case of nicotinic acid, the improvement in hearing was only temporary.[13] The added amino acids not only prolong the action but, as mentioned, improve the functioning of the nervous system and the general response and resistance of the organism as a whole. Patients treated by this method show greater resistance to fatigue, which plays such an enormous role in acoustic disorders. They are therefore able to produce the additional energy needed to overcome their handicap. As a result of our observations, which show an improvement of the organic function, it stands to reason that treatment in early stages of the disease may well prevent any extensive damage of the acoustic organ. The special significance of the new compound lies in its direct influence on the stimulation and the restitution of the function of the auditory nerve itself. If a test after injection discloses an increase in threshold perception and also in acoustic range, this shows that under the conditions created by the medication the ear is still able to achieve this amount of functioning. In cases in which the result is not persistent, the same beneficial effect can be repeatedly obtained by oral medication. The fact that so many ears regain a permanent increase of function indicates, however, that either the conditions of the organism affecting hearing have been permanently improved or that the nerve has undergone permanent changes of a restitutive nature. The following observations speak in favor of the second hypothesis.

Fliers and personnel exposed to the noises of machines and motors often suffer damages to their hearing which manifest themselves in the audiogram first as losses of the frequencies around 4000 double vibrations. Surveys of a great number of school children have also disclosed incipient loss of hearing for the highest tones (above 8000

12. Jellinek, A.: Ueber Hörübungen und ihre Anwendung, Wien. med. Wchnschr. **81**:581, 1931.

13. Guggenheim, L.: Therapy of Deafness: Report of Cases, Laryngoscope **53**:441, 1943. Selfridge.[6]

double vibrations) in children with apparently normal hearing. The new therapy is especially effective in improving the perception of this tone range. If applied in early stages, one may expect it not only to stop further degeneration but also to restore the previously lost function.

In experimental bleeding of animals (Govier [14]) vitamin therapy was able to prevent the general breakdown of the whole organism and shock. What is true for the whole organism certainly applies to a single organ. As our medication has been effective in improving disturbances of an acoustic nature, we may hope that it will serve as a preventive measure to protect the ears against traumatic damage.

Wartime disorders of hearing are frequently combined with severe disturbances of the personality, often resulting in hysterical behavior, so that in some instances it is difficult to differentiate between organic and psychogenic disorders of hearing. This again presents a situation favorable to our therapeutic approach because, in addition to its local effect, it benefits the whole personality.

The subject's willingness or unwillingness to accept contact with the world, his individual situation, also play a part in the conscious use he makes of his sensory perception. A state of general well-being and an impression of strength and energy, as subjective strong reality, increase his tendency to accept and integrate the signals sent to him from the outside. Under changed conditions of the whole person, tending toward a higher neurotone, the response of different organs also may show a higher level of performance and response to stimulation. As the new compound acts in this sense, we have found that it is also helpful in acoustic training of patients in whom fatigue is often a definite handicap.

SUMMARY

Seventy-eight patients have been treated for acoustic disorders with a mixture of amino acids and vitamins, which was administered by intramuscular injection supported by oral administration of capsules containing vitamins and amino acids. Of these 78 patients, 57 showed improvement and 1 showed no improvement (see table). In detail the results were as follows:

In the speech range (512, 1024, 2048):

| | | | | |
|---|---|---|---|---|
| —10 | to | — 5 per cent | 1 patient | (loss) |
| — 5 | to | 0 per cent | 5 patients | no improvements |
| 0 | to | 5 per cent | 25 patients | no improvements |
| 5 | to | 10 per cent | 21 patients | improvements |
| 10 | to | 20 per cent | 17 patients | improvements |
| 20 | | and above | 8 patients | improvements |


14. Govier, W. M.: Rationale for Use of Vitamins in the Therapy of Shock and Anoxia, J. A. M. A. **126**:749-750 (Nov. 18) 1944.

Average of general hearing (128-9742):

| | | | | |
|---|---|---|---|---|
| — 5 | to | 0 per cent | 8 patients | no improvements |
| 0 | to | 5 per cent | 13 patients | no improvements |
| 5 | to | 10 per cent | 26 patients | improvements |
| 10 | to | 20 per cent | 16 patients | improvements |
| 20 | | and above | 15 patients | improvements |

The favorable results were especially reflected in gains of perception of high tones. For a better understanding of this effect, the gains in average percentages are recorded for the whole tone range as well as for the speech range (see table).

350 Central Park West.

*Data on Patients Treated for Acoustic Disorders*

| | | | Average Loss of Hearing of Speech (512, 1028, 2048) | | | | Average Loss of General Hearing (128-9747) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Right Ear | | Left Ear | | Right Ear | | Left Ear | |
| Name | Age | Sex | Before, per Cent | After, per Cent | Before, per Cent | After, per Cent | Before, per Cent | After, per Cent | Before, per Cent | After, per Cent |
| T. T. | 46 | M | 50.6 | 33.3 | 06.8 | 01.3 | 70.0 | 52.8 | 31.2 | 25.6 |
| P. G. | 44 | F | 21.3 | 17.3 | 14.6 | 14.6 | 43.1 | 26.8 | 21.8 | 23.4 |
| E. A. | 32 | F | 72.0 | 51.3 | 100.0 | 98.0 | 78.5 | 73.5 | 100.0 | 96.0 |
| M. G. | 52 | F | 30.6 | 30.6 | 77.3 | 68.5 | 33.5 | 31.2 | 91.2 | 84.3 |
| F. W. | 35 | F | 34.6 | 33.6 | 42.6 | 33.6 | 55.2 | 40.6 | 58.7 | 45.6 |
| G. W. | 67 | F | 25.3 | 17.3 | 21.0 | 20.0 | 43.8 | 36.9 | 47.5 | 25.6 |
| A. D. | 47 | M | 62.6 | 60.0 | 42.6 | 44.0 | 70.6 | 61.8 | 43.7 | 41.6 |
| R. K. | 28 | F | 29.0 | 26.6 | 30.0 | 26.6 | 40.6 | 39.3 | 33.7 | 39.3 |
| D. D. | 48 | M | 30.0 | 29.3 | 28.0 | 28.1 | 50.0 | 58.1 | 44.3 | 31.8 |
| G. F. | 72 | M | 56.0 | 42.6 | 48.0 | 46.6 | 76.2 | 66.8 | 67.0 | 64.0 |
| C. F. | 33 | F | 30.6 | 32.3 | 33.3 | 30.6 | 52.5 | 49.3 | 45.6 | 46.5 |
| B. G. | 69 | M | 18.0 | 05.3 | 28.0 | 18.0 | 55.0 | 38.0 | 65.0 | 58.0 |
| S. T. | 42 | M | 24.0 | 13.3 | 12.0 | 14.0 | 30.1 | 22.5 | 27.5 | 23.6 |
| M. D. | 49 | F | 49.3 | 37.3 | 48.0 | 41.0 | 79.3 | 53.7 | 80.0 | 56.3 |
| E. F. | 15 | M | 44.6 | 02.4 | 54.6 | 01.2 | 53.0 | 03.0 | 60.0 | 03.0 |
| T. M. | 18 | M | 28.0 | 21.3 | 20.0 | 04.0 | 50.6 | 33.3 | 36.2 | 02.5 |
| F. B. | 50 | F | 10.6 | 0 | 37.3 | 42.6 | 31.3 | 08.7 | 71.2 | 65.0 |
| J. H. | 45 | M | 13.3 | 0 | 16.0 | 04.0 | 24.3 | 12.5 | 26.2 | 10.4 |
| E. S. | 41 | F | 06.6 | 02.6 | 0 | 05.3 | 15.3 | 06.8 | 0 | 00.8 |
| J. F. | 49 | M | 42.0 | 08.0 | 24.0 | 09.3 | 65.0 | 21.8 | 38.0 | 25.0 |
| M. D. | 69 | M | 30.6 | 25.3 | 42.6 | 40.0 | 66.2 | 64.0 | 76.0 | 71.8 |
| M. B. | 48 | M | 08.0 | 02.6 | 41.3 | 41.3 | 26.9 | 24.3 | 44.3 | 44.0 |
| S. W. | 38 | F | 64.0 | 50.0 | 64.0 | 44.0 | 84.0 | 81.2 | 85.6 | 81.2 |
| G. B. | 38 | F | 09.3 | 01.3 | 36.0 | 24.0 | 12.5 | 08.7 | 32.5 | 26.8 |
| A. K. | 58 | M | 06.6 | 08.0 | 12.0 | 10.0 | 25.0 | 26.0 | 30.8 | 26.6 |
| J. M. | 52 | M | 24.0 | 21.3 | 18.0 | 12.0 | 47.0 | 53.7 | 44.0 | 38.0 |
| M. P. | 32 | F | 21.3 | 14.6 | 40.0 | 41.6 | 25.0 | 19.0 | 41.0 | 46.0 |
| P. R. | 15 | F | 34.6 | 28.0 | 37.0 | 32.0 | 33.0 | 28.0 | 38.0 | 30.0 |
| K. L. | 34 | M | 82.0 | 57.0 | 66.0 | 62.3 | 82.0 | 57.0 | 75.0 | 74.0 |
| F. T. | 25 | F | 34.6 | 29.3 | 38.6 | 30.6 | 39.3 | 33.7 | 45.6 | 35.3 |

*Data on Patients Treated for Acoustic Disorders—Continued*

| Name | Age | Sex | Average Loss of Hearing of Speech (512, 1024, 2048) | | | | Average Loss of General Hearing (128-9747) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Right Ear | | Left Ear | | Right Ear | | Left Ear | |
| | | | Before, per Cent | After, per Cent | Before, per Cent | After, per Cent | Before, per Cent | After, per Cent | Before, per Cent | After, per Cent |
| E. S. | 22 | F | 31.3 | 21.3 | 21.3 | 21.3 | 31.2 | 25.0 | 22.5 | 21.5 |
| M. O. | 31 | M | 100.0 | 96.0 | 96.0 | 99.4 | 92.0 | 88.5 | 89.5 | 87.0 |
| M. S. | 30 | F | 33.3 | 34.0 | 46.3 | 41.3 | 44.2 | 48.9 | 54.7 | 50.0 |
| V. B. | 15 | F | 12.0 | 22.6 | 10.6 | 10.6 | 21.8 | 27.5 | 21.8 | 23.1 |
| J. W. | 32 | M | 16.0 | 02.0 | 46.0 | 48.0 | 40.0 | 11.0 | 62.1 | 61.8 |
| A. L. | 31 | M | 88.0 | 58.6 | 100.0 | 58.9 | 98.0 | 98.0 | 100.0 | 90.6 |
| I. P. | 35 | F | 41.3 | 34.6 | 37.6 | 36.0 | 50.6 | 46.0 | 55.0 | 46.6 |
| H. C. | 59 | M | 20.0 | 0 | 13.0 | 01.3 | 31.8 | 00.8 | 25.0 | 04.0 |
| A. R. | 45 | M | 40.0 | 37.0 | 72.0 | 66.6 | 43.0 | 35.0 | 86.0 | 68.0 |
| J. K. | 53 | M | 53.3 | 48.0 | 44.0 | 37.0 | 73.3 | 54.3 | 65.5 | 50.0 |
| C. G. | 49 | F | 24.0 | 28.0 | 36.0 | 36.0 | 38.7 | 38.1 | 46.8 | 49.2 |
| C. W. | 43 | M | 46.6 | 41.3 | 41.3 | 41.3 | 63.3 | 52.5 | 73.7 | 59.3 |
| P. Q. | 59 | M | 16.0 | 25.2 | 16.0 | 25.2 | 30.6 | 35.0 | 30.6 | 35.0 |
| J. R. | 37 | M | 37.3 | 26.6 | 44.0 | 25.0 | 63.7 | 48.7 | 67.5 | 50.0 |
| R. F. | 22 | M | 29.3 | 25.3 | 28.0 | 25.1 | 44.2 | 49.0 | 37.8 | 40.0 |
| C. B. | 16 | M | 0 | 01.3 | 06.6 | 08.0 | 00.6 | 0 | 15.6 | 15.6 |
| M. R. | 12 | F | 32.0 | 29.0 | 82.0 | 85.0 | 44.3 | 42.5 | 91.8 | 75.0 |
| M. C. | 50 | M | 74.4 | 80.0 | 78.0 | 78.0 | 96.0 | 95.0 | 99.0 | 94.0 |
| M. C. | 31 | M | 36.3 | 36.6 | 38.6 | 36.0 | 39.3 | 38.1 | 44.3 | 39.3 |
| N. C. | 33 | M | 100.0 | 90.0 | 100.0 | 85.0 | 100.0 | 98.0 | 100.0 | 92.0 |
| F. S. | 32 | F | 33.3 | 37.3 | 30.6 | 30.6 | 39.3 | 48.0 | 36.8 | 40.0 |
| M. G. | 17 | F | 33.3 | 32.0 | 28.0 | 30.0 | 73.0 | 51.0 | 43.1 | 45.0 |
| C. H. | 49 | M | 06.0 | 0 | 50.8 | 48.0 | 73.1 | 51.0 | 43.1 | 45.0 |
| M. K. | 55 | M | 34.0 | 36.0 | 35.0 | 30.0 | 68.6 | 46.2 | 44.3 | 41.6 |
| E. K. | 67 | F | 48.0 | 41.0 | 57.0 | 57.0 | 87.5 | 88.0 | 80.0 | 60.0 |
| M. B. | 50 | M | 08.0 | 02.6 | 41.3 | 41.3 | 26.9 | 24.3 | 44.3 | 44.3 |
| B. S. | 26 | F | 22.6 | 21.3 | 36.0 | 32.0 | 40.0 | 51.8 | 54.3 | 41.8 |
| G. C. | 49 | M | 02.6 | 01.3 | 09.3 | 05.0 | 09.3 | 07.3 | 20.3 | 13.1 |
| H. F. | 46 | M | 33.3 | 29.3 | 45.3 | 37.3 | 43.1 | 36.7 | 71.1 | 55.0 |
| H. K. | 24 | M | 41.3 | 37.0 | 20.0 | 20.0 | 47.5 | 46.8 | 30.6 | 26.2 |
| M. S. | 37 | M | 24.0 | 25.3 | 30.6 | 34.6 | 35.0 | 35.0 | 45.6 | 49.3 |
| M. Y. | 59 | F | 46.6 | 46.6 | 39.0 | 41.3 | 59.3 | 53.1 | 53.0 | 50.0 |
| N. H. | 38 | M | 30.5 | 36.0 | 38.5 | 32.0 | 31.2 | 28.7 | 36.2 | 26.8 |
| L. H. | 40 | F | 52.0 | 58.6 | 04.0 | 05.3 | 70.6 | 85.0 | 15.0 | 11.8 |
| L. A. | 42 | M | 18.6 | 13.8 | 0 | —01.3 | 60.8 | 42.5 | 17.5 | 13.7 |
| J. S. | 68 | F | 18.6 | 18.6 | 50.2 | 28.0 | 36.8 | 35.6 | 85.5 | 45.0 |
| A. H. | 46 | M | 61.3 | 65.3 | 48.0 | 50.6 | 88.7 | 91.8 | 79.3 | 80.0 |
| P. C. | 69 | M | 16.0 | 16.0 | 20.0 | 21.2 | 30.8 | 25.6 | 35.6 | 33.1 |
| F. L. | 46 | M | 36.0 | 01.3 | 24.0 | 13.2 | 36.1 | 06.2 | 28.8 | 13.1 |
| M. B. | 52 | M | 41.3 | 45.3 | 08.0 | 08.0 | 26.8 | 27.5 | 54.3 | 58.1 |
| R. H. | 28 | F | 41.3 | 25.3 | 36.0 | 29.3 | 50.0 | 37.5 | 41.2 | 36.1 |
| C. I. | 48 | M | 50.0 | 56.0 | 49.3 | 45.3 | 84.3 | 86.8 | 73.0 | 72.5 |
| P. S. | 45 | M | 06.0 | 05.3 | 49.3 | 49.3 | 26.8 | 18.1 | 59.3 | 59.3 |
| J. K. | 26 | F | 43.3 | 36.0 | 53.0 | 44.0 | 48.7 | 46.8 | 82.5 | 75.0 |
| E. R. | 44 | F | 65.0 | 61.0 | 40.0 | 36.0 | 91.8 | 86.2 | 74.3 | 67.5 |
| F. T. | 25 | F | 34.7 | 33.3 | 40.0 | 33.3 | 38.7 | 37.5 | 45.0 | 39.3 |
| M. T. | 14 | M | 08.0 | 09.3 | 42.0 | 40.0 | 18.0 | 15.0 | 52.5 | 55.6 |
| H. F. | 30 | M | 08.0 | 04.0 | 25.2 | 25.2 | 14.1 | 10.1 | 27.5 | 28.1 |

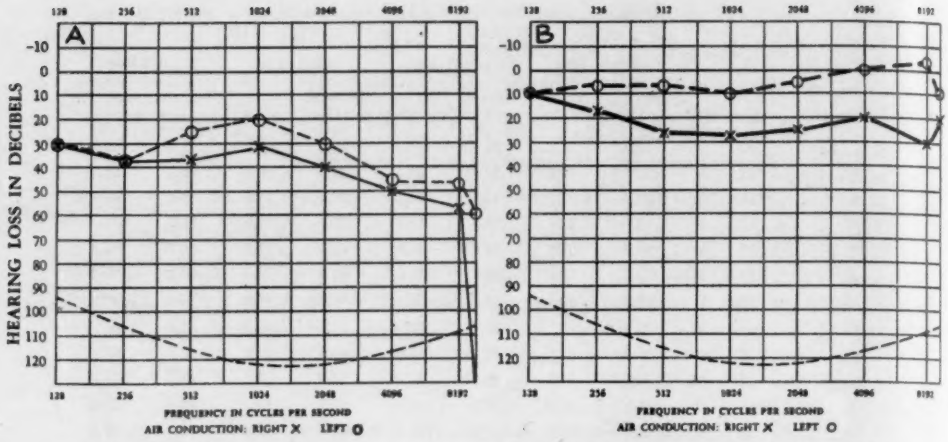


Chart 1.—Audiograms of T. M., a youth aged 18: *A*, taken Jan. 30, 1945; *B*, taken April 27, 1945, after he had received fifteen injections.

The initial andiometric test showed losses of hearing as follows:

| | |
|---|---|
| Speech range | 28 % right, 20 % left |
| Whole range | 50.6% right, 36.2% left |

After fifteen injections the losses were:

| | |
|---|---|
| Speech range | 2% right, 2.6% left |
| Whole range | 21% right, 5 % left |

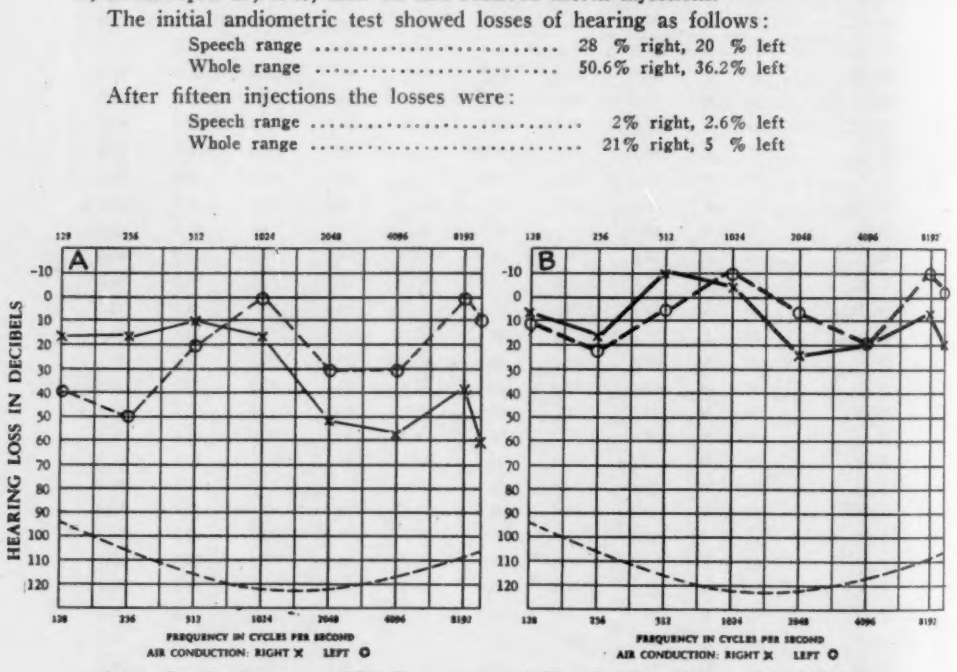


Chart 2.—Audiograms of H. C., a man aged 59: *A*, taken June 1, 1943; *B*, taken June 15, 1943, after he had received five injections. This patient had been aware of difficulty in hearing with his right ear for several months and had noticed a noise in this ear for about two weeks. His father was hard of hearing.

The initial audiometric test revealed losses of hearing as follows:

| | |
|---|---|
| Speech range | 20 % right, 13.3% left |
| Whole range | 30.8% right, 25 % left |

After five injections the losses were:

| | |
|---|---|
| Speech range | 2.6% right, 0 % left |
| Whole range | 8.7% right, 4.1% left |

The patient states that the noise has disappeared.

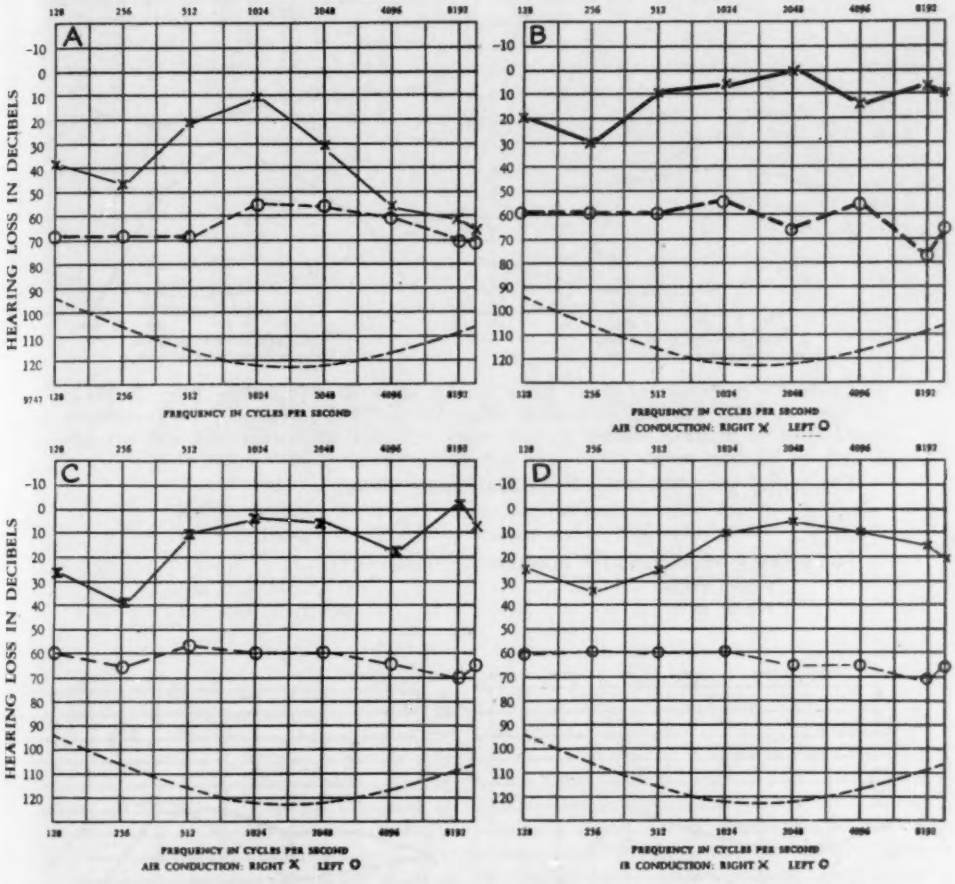


Chart 3.—Audiograms of J. W., a man aged 36: *A*, taken May 4, 1043; *B*, taken May 27, 1943, after eleven injections; *C*, March 7, 1944; *D*, Oct. 16, 1945, after twenty-four additional injections. This patient had noticed difficulties in hearing five years prior to examination, especially in his left ear. The condition gradually became worse.

The initial test (*A*) showed loss of hearing as follows:

| | |
|---|---|
| Speech range | 16% right, 46.6% left |
| Whole range | 40% right, 62.1% left |

After eleven injections (*B*) the losses were:

| | |
|---|---|
| Speech range | 2 % right, 48 % left |
| Whole range | 11.8% right, 61.8% left |

Examination nine months later (the patient not having been treated in the interval) showed that the improvement was maintained (*C*):

| | |
|---|---|
| Speech range | 5.3% right, 49.3% left |
| Whole range | 13.1% right, 60 % left |

After twenty-four additional injections the losses were:

| | |
|---|---|
| Speech range | 10.6% right, 49.3% left |
| Whole range | 18.1% right, 62.5% left |

The improvement was therefore approximately maintained.

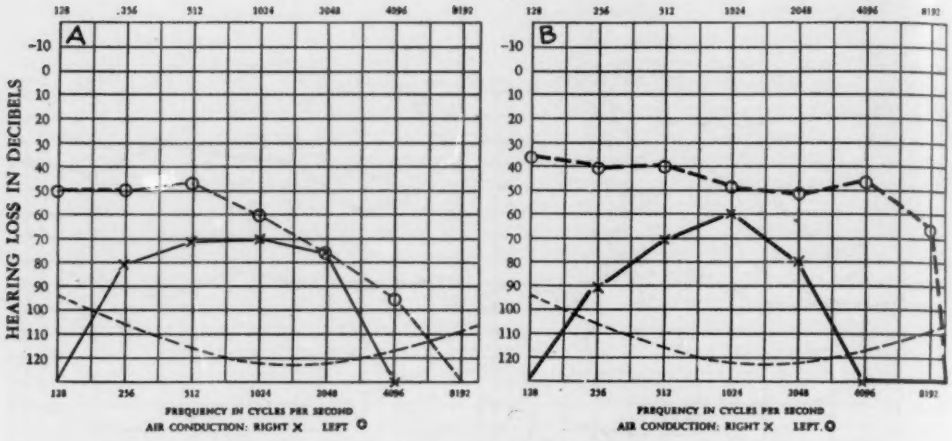


Chart 4.—Audiograms of E. K., a woman aged 67: *A*, taken Sept. 2, 1943; *B*, Sept. 2, 1943, showing immediate effect of the first injection. This woman's impairment of hearing started twelve years before examination and was accompanied by buzzing noises.

The initial test showed losses of hearing as follows:

Speech range ..... 57 % right, 48 % left
Whole range ..... 87.5% right, 79.4% left

Immediately after the first injection the losses were:

Speech range ..... 51% right, 41% left
Whole range ..... 88% right, 60% left

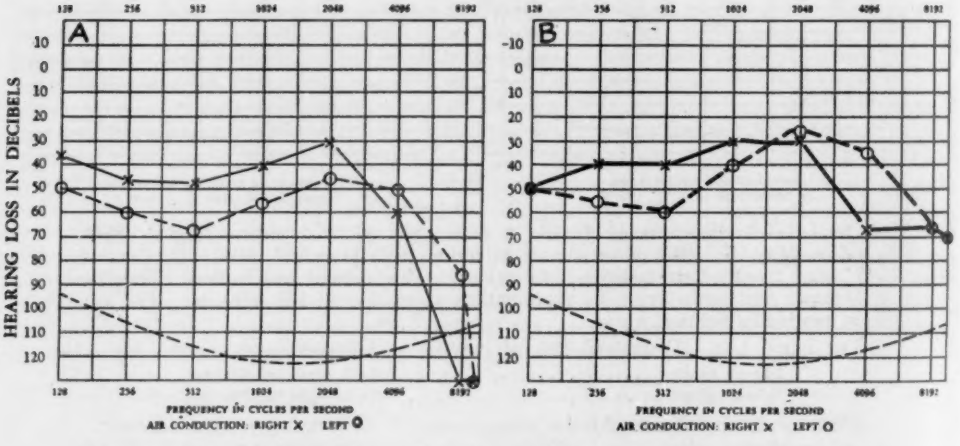


Chart 5.—Audiograms of J. R., a man aged 37: *A*, taken July 27, 1943; *B*, Aug. 3, 1943. The patient had shown progressive loss of hearing for fifteen years prior to examination. He was discharged from the Army because of his hearing loss.

The initial test showed losses of hearing as follows:

Speech range ..... 37.3% right, 44 % left
Whole range ..... 63.3% right, 67.5% left

After six injections the losses were:

Speech range ..... 26.6% right, 25.3% left
Whole range ..... 48.7% right, 50 % left

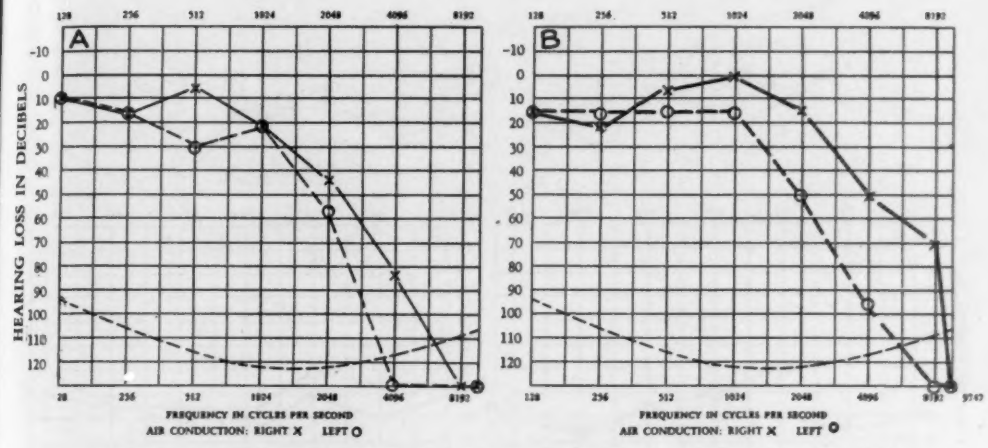


Chart 6.—Audiograms of B. G., a man aged 69: *A*, taken Nov. 21, 1944; *B*, Jan. 11, 1945. This patient complained of bilateral impairment of hearing for six months prior to examination.

The initial test showed losses of hearing as follows:

| | |
|---|---|
| Speech range | 12% right, 28% left |
| Whole range | 55% right, 65% left |

After forty-six injections the losses were:

| | |
|---|---|
| Speech range | 5.3% right, 21.3% left |
| Whole range | 38 % right, 58 % left |

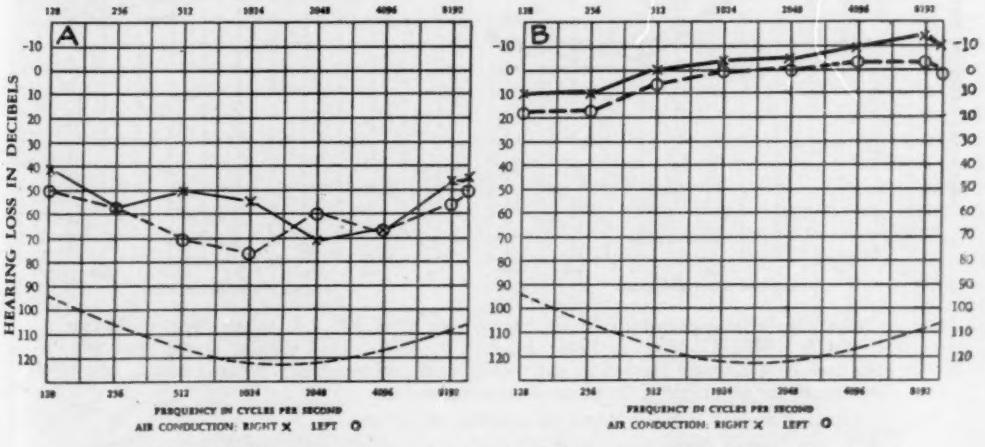


Chart 7.—Audiograms of E. F., a youth aged 15: *A*, taken Dec. 21, 1943; *B*, Jan. 27, 1944. This patient had noticed gradually increasing difficulties in hearing for about two months.

The initial test showed losses of hearing as follows:

| | |
|---|---|
| Speech range | 44.6% right, 54% left |
| Whole range | 53 % right, 60% left |

After eight injections the losses were:

| | |
|---|---|
| Speech range | 2.4% right, 1.2% left |
| Whole range | 3 % right, 3 % left |

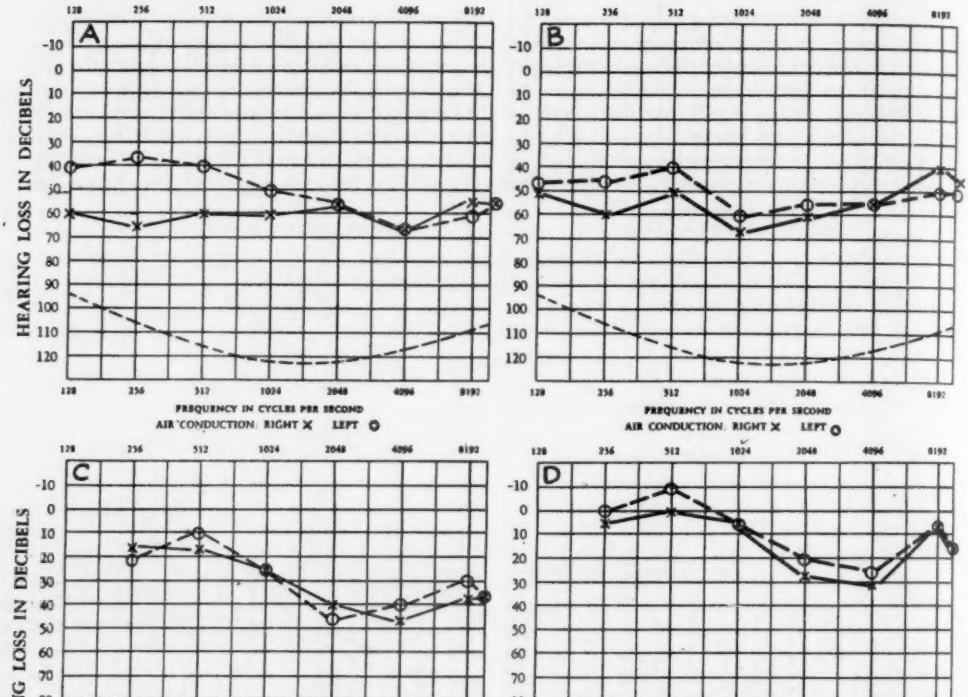


Chart 8.—Audiograms of M. Y., a woman aged 59: *A*, taken Nov. 2, 1944; *B*, Jan. 9, 1945; *C*, Nov. 2, 1944; *D*, Jan. 9, 1945. This patient stated that her impairment of hearing started in early childhood and gradually became worse. She complained in addition of continuous buzzing noises.

The initial test showed losses of hearing as follows:

| | |
|---|---|
| Speech range | 46.6% right, 39 % left |
| Whole range | 59.3% right, 53.1% left |

After fifteen injections the losses were:

| | |
|---|---|
| Speech range | 46.6% right, 41.3% left |
| Whole range | 53 % right, 50 % left |

A test five months later, May 1945, showed that the improvement in hearing was maintained.

*C* shows the initial bone conduction readings, and *D*, the readings after fifteen injections.

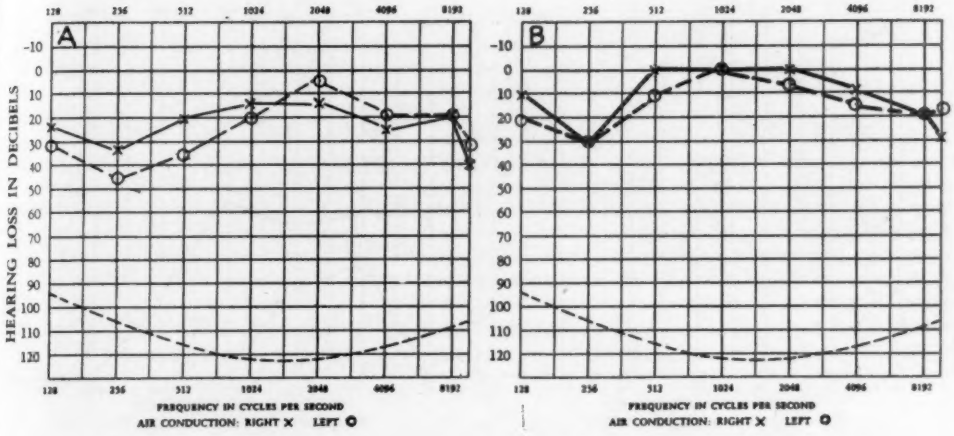


Chart 9.—Audiograms of J. H., a man aged 45: *A*, taken Sept. 7, 1944; *B*, Sept. 21, 1944. The patient complained of noises in his right ear for about two months prior to examination but was not under the impression that his hearing was impaired.

Before treatment the audiometric test showed losses as follows:

| | |
|---|---|
| Speech range | 13.3% right, 16 % left |
| Whole range | 24.3% right, 26.2% left |

After ten injections the losses were:

| | |
|---|---|
| Speech range | 0 % right, 4.4% left |
| Whole range | 12.5% right, 15.6% left |

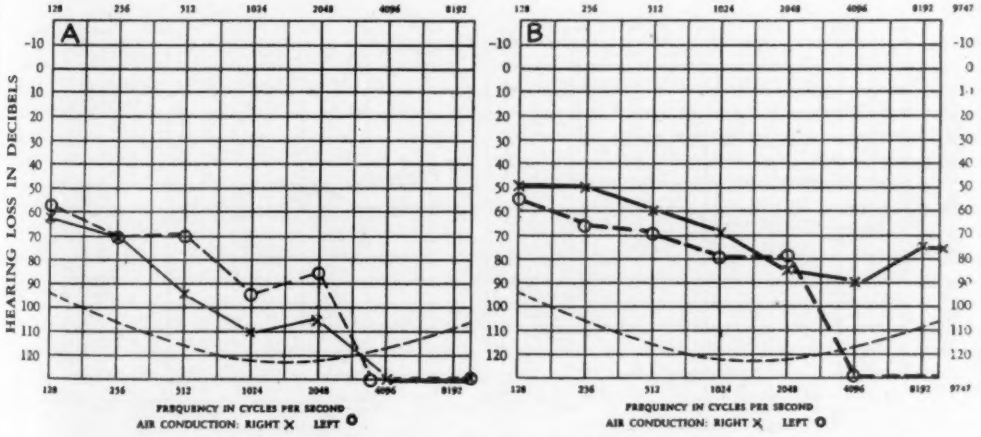


Chart 10.—Audiograms of K. L., a man aged 34. *A*, taken March 29, 1944; *B*, Sept. 28, 1944. Difficulty of hearing started in both ears about eight years prior to examination and gradually increased. The patient was rejected by the Army. His mother was hard of hearing.

An audiometric test before treatment showed losses as follows:

| | |
|---|---|
| Speech range | 82.6% right, 66.6% left |
| Whole range | 82.8% right, 76.4% left |

After twenty-four injections the losses were:

| | |
|---|---|
| Speech range | 57.3% right, 62.3% left |
| Whole range | 53.2% right, 74 % left |

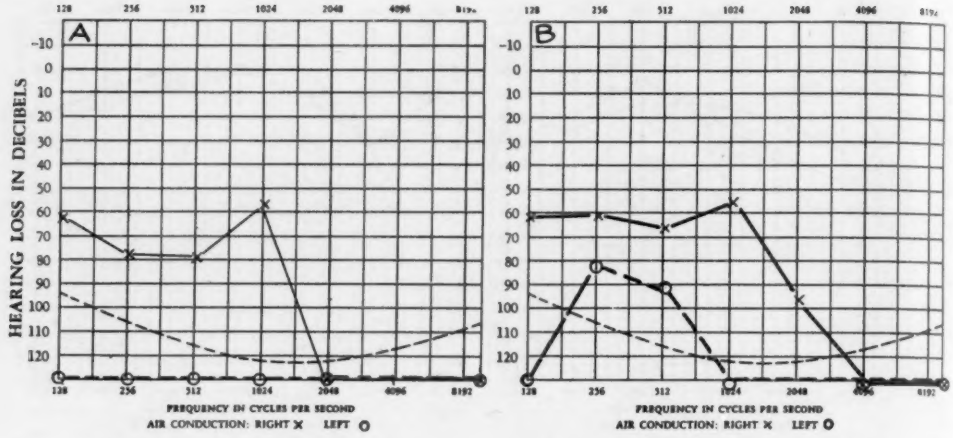


Chart 11.—Audiograms of E. A., a woman aged 33: *A,* taken April 24, 1945; *B,* June 7, 1945. The patient's impairment of hearing started when she was 12 and gradually became worse.

The initial test showed losses of hearing as follows:

| | |
|---|---|
| Speech range | 72 % right, 100% left |
| Whole range | 78.5% right, 100% left |

After twelve injections the losses were:

| | |
|---|---|
| Speech range | 57.3% right, 93.2% left |
| Whole range | 73.4% right, 96.8% left |

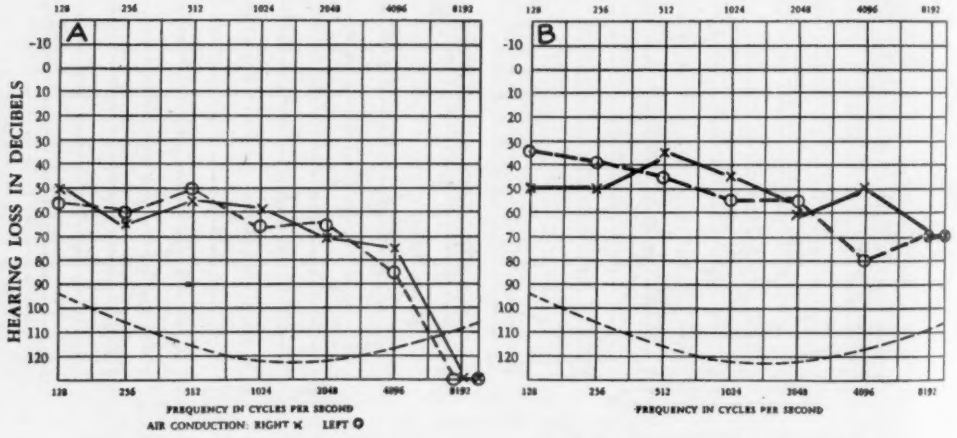


Chart 12.—Audiograms of M. D., a woman aged 49: *A,* taken Sept. 12, 1944; *B,* Oct. 5, 1944. The difficulty in hearing started about one year prior to examination, especially in the left ear, and gradually became worse.

The initial test showed losses of hearing as follows:

| | |
|---|---|
| Speech range | 49.3% right, 48% left |
| Whole range | 79.3% right, 80% left |

After eight injections the losses were:

| | |
|---|---|
| Speech range | 37.3% right, 41.3% left |
| Whole range | 53.7% right, 56.3% left |

# BURNS OF THE UPPER RESPIRATORY TRACT AND EYES FROM A NITROGEN-MUSTARD GAS (1149)

## A Clinical Study

GEORGE I. UHDE, M.D.*
MAUI, TERRITORY OF HAWAII

THE NITROGEN-MUSTARD gases were developed during World War II. Since there has been little clinical experience with these gases, it is believed worth while to record the following detailed information collected on 8 casualties from 1149 (code) vapor. This (1149) is probably the most effective nitrogen-mustard.

The conditions of these casualties resulted during the developmental operation of a pilot plant at Edgewood Arsenal, Md. Two other casualties were hospitalized for cutaneous burns, and 10 additional patients with minor complaints were treated in the outpatient clinic. Meanwhile the safety problems in the operation of the pilot plant were solved, and no further casualties appeared at this particular time.

### ANALYSIS OF CASES

It was impossible to estimate accurately the casualty rate, because of variation in production schedule and shift of employees. The casualty rate appeared high in the opinion of the workers in the pilot plant, all of whom had previous experience with mustard vapor, but this observation is probably not significant.

Three of the casualties (37 per cent) were military personnel, and the remaining 5 (62 per cent) were civilians. The average age was 31 years, the youngest being 22 years and the oldest 46 years. All employees were men. There was 1 Negro. Six casualties (75 per cent) complained of smelling a "fishy" odor on exposure, but 2 patients (25 per cent) were unable to detect any odor whatever. The mean interval between known exposure and onset of symptoms was six hours, the shortest interval being four hours and the longest ten hours. The average period of hospitalization was fifteen plus days.

The commonest complaint was hoarseness.

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From the Department of Otolaryngology (service of Ralph A. Fenton), University of Oregon Medical School Hospitals and Clinics.

* Formerly Chief, Eye, Ear, Nose and Throat Service, Station Hospital, United States Army Chemical Warfare Center, Edgewood Arsenal, and Chief, Gas Casualty Division, Office Surgeon, United Kingdom Base, European Theater of Operations, United States Army.

Eighty-seven per cent of the casualties coughed. That the resistance of the mucosal surfaces of the upper respiratory tract was lowered to either symbiotic or secondary micro-organisms was evidenced by the fact that the cough was eventually productive of thick yellowish white sputum in 62 per cent of the patients. In addition, in 1 patient (12 per cent) a purulent nasal discharge developed.

TABLE 1.—*Status, Age, Sex, Color, Odor Detection, Interval Between Exposure and Onset of Symptoms and Hospitalization Period in Each of Eight Cases of Nitrogen-Mustard Burns*

| Hospital Register Number | Status | Age | Sex | Color | Odor Detected | Interval Between Exposure and Onset of Symptoms, Hr. | Total Hospitalization, Days |
|---|---|---|---|---|---|---|---|
| 29589 | Second lieutenant | 22 | M | W | Fishy | Unknown | 15 |
| 29518 | Private | 26 | M | W | Fishy | 4 | 8 |
| 29319 | Second lieutenant | 26 | M | W | None | 4 | 26 |
| 28740 | Civilian | 27 | M | N | None | 6 | 14 |
| 29571 | Civilian | 30 | M | W | Fishy | Unknown | 18 |
| 29632 | Civilian | 36 | M | W | Fishy | Unknown | 8 |
| 29376 | Civilian | 40 | M | W | Fishy | 10 | 18 |
| 29587 | Civilian | 46 | M | W | Fishy | Unknown | 15 |

TABLE 2.—*Absolute and Relative Frequency of Occurrence of Different Symptoms in Eight Cases of Nitrogen-Mustard Burns*

| | | Casualties with Symptoms | | | |
|---|---|---|---|---|---|
| | | Before Hospitalization | | After Hospital Admission | |
| Order | Symptom | Number | Percentage | Number | Percentage |
| 1 | Hoarseness | 7 | 88 | 8 | 100 |
| 2 | Cough | | | | |
| | Nonproductive | 6 | 75 | 2 | 25 |
| | Productive | 1 | 12 | 5 | 62 |
| 3 | Burning sensation in eyes | 4 | 50 | 4 | 50 |
| 4 | Rhinorrhea | 4 | 50 | 3 | 37 |
| 5 | Sore throat | 3 | 37 | 3 | 37 |
| 6 | Headache | 2 | 25 | 2 | 25 |
| 7 | Lacrimation | 2 | 25 | 2 | 25 |
| 8 | Photophobia | 2 | 25 | 2 | 25 |
| 9 | Nausea | 2 | 25 | 2 | 25 |
| 10 | Vomiting | 2 | 25 | 2 | 25 |
| 11 | Feverish | 2 | 25 | 2 | 25 |
| 12 | Malaise | 2 | 25 | 2 | 25 |
| 13 | Irritation of lungs | 2 | 25 | 2 | 25 |
| 14 | Irritation of nasal passages | 1 | 12 | 1 | 12 |
| 15 | Pain in eyes | 1 | 12 | 1 | 12 |
| 16 | Vertigo | 1 | 12 | 1 | 12 |
| 17 | Substernal pain on coughing | 0 | 0 | 1 | 12 |
| 18 | Purulent nasal discharge | 0 | 0 | 1 | 12 |

A burning sensation in the eyes, rhinorrhea and sore throat were the next most frequent complaints.

Clinical features of toxicity were characterized by headache, nausea, vomiting, vertigo, malaise and a feverish feeling.

Since hoarseness was the commonest complaint, it is not surprising that all the casualties showed redness and swelling of the mucosa over

the arytenoids and in the interarytenoid space. The remaining mucosa of the upper respiratory tract was also inflamed but to a lesser extent. The vocal cords of 1 patient were inflamed. Small, shallow, grayish ulcers, usually measuring 5 to 10 mm. in diameter, covered the vocal cords of 1 patient, ventricular folds of 2 patients, nasal schneiderian mucosa of 1 patient and the palate of another patient (fig. 2). In other words, 62 per cent of the casualties had ulceration of the upper respir-

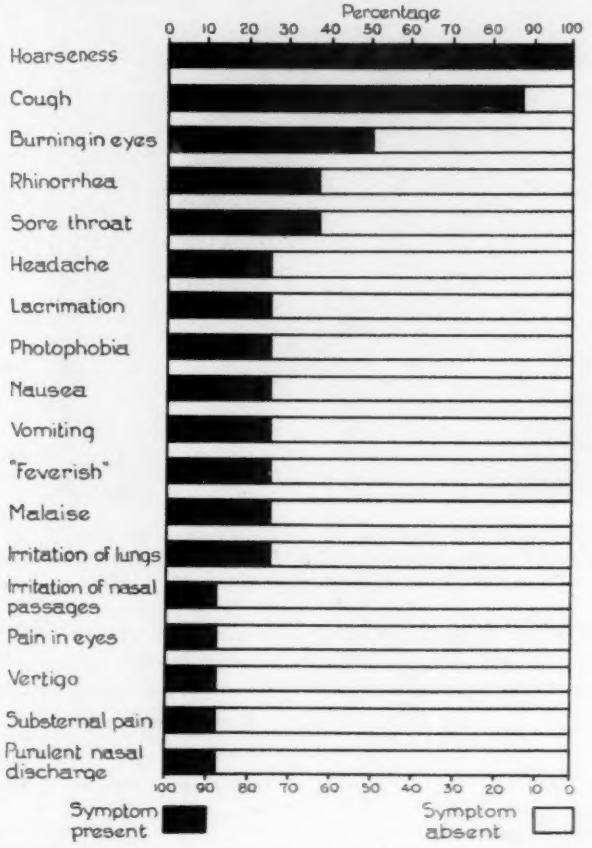


Fig. 1.—Bar diagram based on data of table 2, showing the relative frequency of symptoms in nitrogen-mustard burns.

atory tract. These ulcers bled whenever the grayish membrane was removed.

Three fourths of the patients had crepitant rales in their lungs, but the roentgenograms were normal (table 7).

In 1 casualty a purulent discharge developed from the middle meatuses on the twelfth hospital day. Roentgenograms showed cloudiness of both antrums. Pus was obtained on irrigation.

All 8 casualties had some conjunctival injection. The corneas of 4 patients complaining of a burning sensation in the eyes were stained with fluorescein. Slit lamp examination revealed that the damage was superficial, limited to the epithelial cells and punctate.

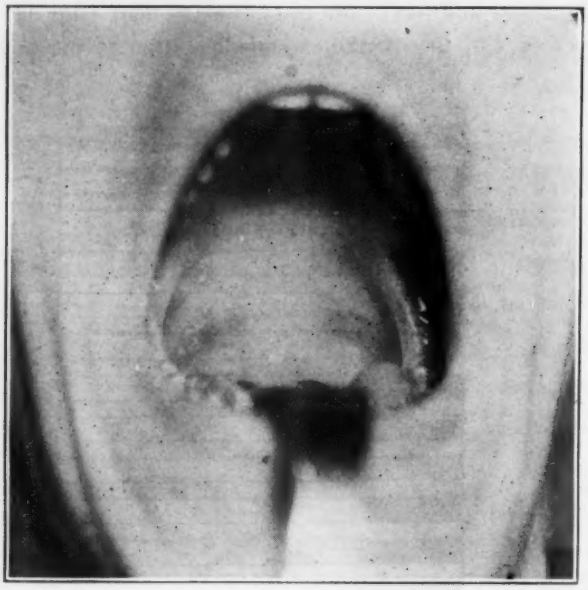

Fig. 2.—Monochrome reproduction of a kodachrome photograph of diffuse inflammation of palate, with localized areas of superficial erosions covered with grayish exudate after exposure to a nitrogen-mustard gas (1149).

TABLE 3.—*Absolute and Relative Frequency of Occurrence of Different Signs in Eight Cases of Nitrogen-Mustard Burns*

| | | Casualties with Signs | | | |
|---|---|---|---|---|---|
| | | Before Hospitalization | | After Hospital Admission | |
| Order | Sign | Number | Percentage | Number | Percentage |
| 1 | Conjunctival injection ..... | 8 | 100 | 8 | 100 |
| 2 | Inflammation of upper respiratory tract ..... | 7 | 88 | 8 | 100 |
| 3 | Rales in lungs..... | 4 | 50 | 6 | 75 |
| 4 | Superficial punctate keratitis.. | 4 | 50 | 4 | 50 |
| 5 | Ulceration of ventricular folds | 1 | 12 | 2 | 25 |
| 6 | Inflammation of vocal cords.. | 1 | 12 | 1 | 12 |
| 7 | Ulceration of nasal mucosa... | 1 | 12 | 1 | 12 |
| 8 | Ulceration of soft palate..... | 1 | 12 | 1 | 12 |
| 9 | Edema of lids..... | 1 | 12 | 1 | 12 |
| 10 | Conjunctival hemorrhage ... | 1 | 12 | 1 | 12 |
| 11 | Ulceration of vocal cords..... | 0 | 0 | 1 | 12 |
| 12 | Purulent maxillary sinusitis.. | 0 | 0 | 1 | 12 |

The clinical course of over half the casualties was febrile, with a concomitant increase in pulse and respiratory rates. Fever persisted in 2 patients for eleven and nineteen hospital days.

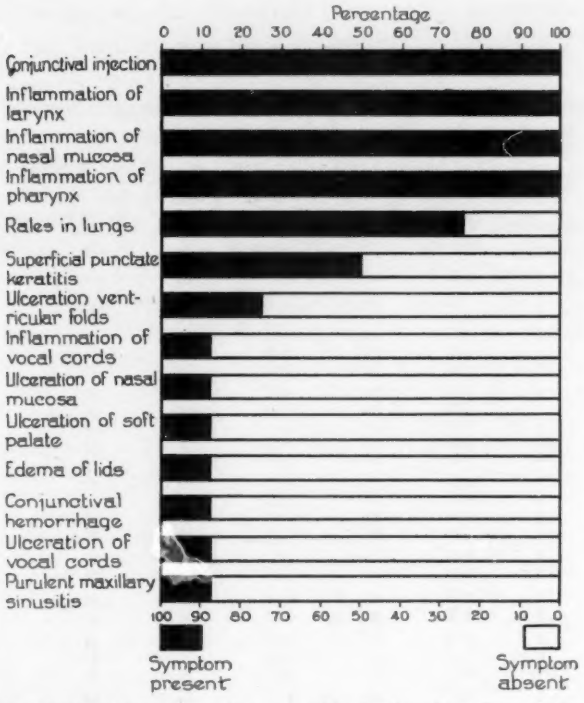


Fig. 3.—Bar diagram based on data of table 3, showing the relative frequency of different signs in nitrogen-mustard burns.

TABLE 4.—*Temperatures, Pulse and Respiratory Rates in Eight Cases of Nitrogen-Mustard Burns*

| Hospital Register Number | Hospital Days | Temperature, F. | Pulse Rate | Respiratory Rate |
|---|---|---|---|---|
| 28740 | 1 | 98.4 | 96 | 18 |
| 29319 | 1 | 103 | 120 | 28 |
| | 2 | 104.4 | | |
| | 3 | 99 | | |
| | 4-19 | 98.8 to 100 | | |
| 29376 | 1 | 103 | 110 | 28 |
| | 2 | 98.4 | ... | 18 |
| | 4 | 99.8 | | |
| | 5-11 | 99 to 99.8 | | |
| | 12 | 98.8 | | |
| 29518 | 1 | 99 | 100 | Normal |
| | 2 | 98.8 | | |
| 29571 | 1 | 98.4 | 100 | Normal |
| | 3 | 100 | | |
| 29587 | 1 | 98.4 | Normal | Normal |
| 29589 | 1 | Normal | Normal | Normal |
| 29632 | 1 | 99.6 | 100 | 20 |
| | 2 | 98.8 | Normal | Normal |

There were no significant changes in the total erythrocytes and leukocytes, differential counts and volume per cubic centimeter of cells.

The sedimentation rates were elevated in 50 per cent of the casualties. Uric acid was slightly increased in 4 out of 8 patients, and the chlorides

TABLE 5.—*Hemograms in Eight Cases of Nitrogen-Mustard Burns*

| Hospital Register Number | Hospital Days | Red Blood Cells, Millions | Hemoglobin, % | White Blood Cells, Thousands | Differential Count: Polymorphonuclears, % | Differential Count: Lymphocytes, % | Differential Count: Eosinophils, % | Hematocrit Level |
|---|---|---|---|---|---|---|---|---|
| 28740 | 1 | 4.52 | 90 | 9.3 | 73 | 27 | | |
| 29319 | 1 | 4.99 | 86 | 12.15 | 80 | 20 | .. | 40 |
| | 5 | 4.51 | 88 | 10.75 | 78 | 22 | | |
| | 7 | 4.71 | 94 | 10.75 | 69 | 31 | | |
| | 16 | 4.51 | 91 | 8.10 | 69 | 31 | | |
| | 19 | 4.55 | 90 | 5.8 | 72 | 28 | | |
| 29376 | 1 | 4.85 | 95 | 8.65 | 62 | 36 | 2 | |
| | 3 | 4.70 | 96 | 7.65 | 61 | 39 | | |
| | 9 | 4.43 | 89 | 7.5 | 70 | 30 | | |
| | 12 | 4.61 | 95 | 6.25 | 63 | 37 | | |
| | 15 | 4.39 | 95 | 5.5 | 70 | 30 | | |
| 29518 | 1 | 4.0 | 97 | 9.2 | 69 | 31 | | |
| | 2 | 4.3 | 98 | 11.95 | | | | |
| | 5 | 4.39 | 89 | 5.45 | 71 | 28 | 1 | |
| | 7 | 4.85 | 100 | 9.1 | 73 | 27 | | |
| 29571 | 1 | 5.14 | 95 | 5.5 | 75 | 25 | | |
| | 6 | 5.06 | 96 | 6.25 | 72 | 28 | | |
| 29587 | 1 | 4.35 | 95 | 6.25 | 60 | 40 | | |
| | 6 | 4.30 | 93 | 4.35 | 57 | 43 | | |
| 29589 | 1 | 4.06 | 83 | 6.15 | 52 | 44 | | |
| | 6 | 4.55 | 93 | 7.30 | 55 | 45 | | |
| | 11 | 5.0 | 97 | 6.2 | 55 | 45 | | |
| 29632 | 1 | 4.5 | 93 | 4.7 | 55 | 45 | | |
| | 4 | 4.72 | 100 | 8.4 | 66 | 34 | | |

TABLE 6.—*Sedimentation Rates and Blood Chemistry in Eight Cases of Nitrogen-Mustard Burns*

| Hospital Register Number | Hospital Days | Sedimentation Rate, Mm.: 15 Min. | 30 Min. | 45 Min. | 60 Min. | Blood Chemistry, Mg./100 Cc.: Nonprotein Nitrogen | Uric Acid | Sugar | Chlorides | Cholesterol |
|---|---|---|---|---|---|---|---|---|---|---|
| 29319 | 1 | ... | .... | .... | .... | 34 | 4.6 | 106 | 455 | |
| | 3 | ... | 10 | 14 | 16.5 | | | | | |
| | 7 | 2 | 10 | 17 | 20 | | | | | |
| | 13 | 5 | 11 | 17 | 19 | | | | | |
| | 19 | 1 | 8 | 14 | 18.5 | | | | | |
| 29376 | 3 | 5 | 13 | 18.5 | 21 | | | | | |
| | 9 | 8 | 17 | 21 | 22.5 | | | | | |
| | 12 | 2.5 | 6 | 10 | 13.5 | | | | | |
| 29518 | 2 | 0.1 | 2.0 | 3.9 | 5.0 | | | | | |
| | 5 | 1.0 | 3.2 | 6.0 | 8.0 | | | | | |
| 29571 | 1 | 2.0 | 6.0 | 9.2 | 11.8 | 32.7 | 6.7 | 95 | ... | 178.5 |
| 29587 | 1 | 1.5 | 4.0 | 6.2 | 8.5 | 30 | 6.1 | 108 | ... | 222 |
| | 6 | 0.3 | 2.0 | 4.0 | 6.0 | | | | | |
| 29589 | 1 | 3.5 | 8.0 | 12.0 | 15.0 | 26.7 | 6.0 | 102 | ... | 217 |
| | 6 | 1.5 | 4.5 | 7.3 | 9.0 | | | | | |
| | 11 | 0.1 | 2.0 | 4.0 | 6.0 | | | | | |
| 29632 | 4 | ... | .... | .... | .... | .... | 5.0 | | | |

were decreased in 1 patient. The latter two findings are probably of no significance.

The remaining laboratory findings are given in table 7.

REPORT OF A REPRESENTATIVE CASE OF VAPOR BURN

D. J. T., a second lieutenant, a white man aged 26 years, was admitted to the hospital on Feb. 19, 1943.

The family history and past history were noncontributory.

*History of Present Illness.*—On Jan. 15, 1943 a steam hose was used to clean a screen heavily contaminated with 1149. The patient had on his gas mask over his gas mask spectacles and wore rubber gloves and protective clothing.

Four hours later he was conscious of a slight burning in both eyes. Eight hours after exposure he was awakened from a sound sleep by severe pain in both eyes. He was examined and treated in the eye clinic. The conjunctival vessels, especially in the interpalpebral space, were injected. There were decided photophobia and lacrimation. Except for the hyperemia all symptoms subsided forty-eight hours later. The hyperemia persisted for the next five days.

TABLE 7.—*Kahn Reaction, Urinalysis, Icterus Index, Gastric Analysis, Cultures and Roentgenograms in Each of Eight Cases of Nitrogen-Mustard Burns*

| Hospital Register Number | Hospital Days | Kahn Reaction | Urinalysis | Icterus Index | Gastric Analysis | Culture | Roentgenograms |
|---|---|---|---|---|---|---|---|
| 28740 | 1 | Negative | | | | | |
| 29319 | 1 | ..... | Normal | 6.8 | ..... | ..... | Normal |
| | 3 | Negative | | | | | |
| | 13 | ..... | ..... | ... | Normal | | |
| | 16 | ..... | ..... | ... | ..... | ..... | Normal |
| 29376 | 1 | ..... | Normal | ... | ..... | ..... | Normal |
| | 3 | Negative | ..... | ... | ..... | Sputum: pneumococci | |
| | 9 | ..... | ..... | ... | Normal | | |
| | 12 | ..... | ..... | ... | ..... | ..... | Normal |
| 29518 | 1 | ..... | Normal | ... | ..... | Ulcer of soft palate: Neisseria catarrhalis and Streptococcus viridans | |
| | 4 | ..... | ..... | ... | Normal | ..... | Normal |
| | 5 | Negative | | | | | |
| 29571 | 1 | Negative | Normal | ... | ..... | ..... | Normal |
| | 11 | ..... | ..... | ... | ..... | ..... | Normal |
| 29587 | 1 | Negative | Normal | ... | ..... | ..... | Normal |
| | 11 | ..... | ..... | ... | ..... | ..... | Normal |
| 29589 | 1 | Negative | Normal | ... | ..... | ..... | Normal |
| | 6 | ..... | ..... | ... | ..... | ..... | Normal |
| 29632 | 1 | Negative | Normal | ... | ..... | ..... | Normal |

On the fifth day after exposure the patient became hoarse and a nonproductive cough and severe rhinorrhea developed. The coughing occurred from fifteen minutes to two hours after each meal and appeared to be induced by epigastric distress and vomiting. It was the patient's impression that there was a raw spot in his stomach and that the coughing and vomiting were effected by food touching this area. Drinking fruit juices invariably resulted in a burning sensation in his throat and substernal region. Although the vomiting disappeared on the tenth day after exposure, the cough and hoarseness persisted.

On Feb. 14, 1943 the patient was again exposed to 1149 vapor. This occurred when a 5 gallon (18.9 liters) can of contaminated warm wash water was accidentally spilled on the floor. A fishy odor was observed, and the lieutenant immediately adjusted his gas mask.

Four hours later the patient had a burning sensation in both eyes.

Although he did not feel well, his work was so important and urgent and therefore a sufficient incentive for him not to desire hospitalization that he avoided

medical treatment. Nevertheless, four days later, feverish, coughing and vomiting, he felt so ill that he was unable to carry on with his work. He was admitted to the hospital.

*Physical Examination on Admission.*—The patient was acutely ill, with flushed face, hoarseness, rhinorrhea, temperature of 103 F. and pulse and respiratory rates of 120 and 28 per minute respectively. The skin was normal, without cyanosis. The pupils were equal and reacted well to light and in accommodation. All conjunctival vessels were injected. There was a nebular area of haziness (epithelial edema), which did not stain with fluorescein, in the visual axis of the cornea of the left eye. The ears were normal. On both sides of the nasal septum and on the left inferior turbinate the mucosa was inflamed and covered with patches of a grayish membrane, which on removal left bleeding ulcers. The remaining schneiderian mucous membrane was acutely swollen, and the nasal passages were filled with mucoid discharge. The pharynx was diffusely inflamed. The entire larynx, including the vocal cords, was swollen, but the injection and edema especially involved the mucosa covering the arytenoid cartilages and the interarytenoid space. There was normal vesicular resonance throughout the lungs. The heart sounds were of good quality. The abdomen and extremities were normal.

*Clinical Course.*—Codeine relieved his cough. His temperature during the first twelve hours rose to 104.4 and then by lysis fell to 99 F. on the third hospital day. The temperature fluctuated between 98 and 100 F. until the nineteenth day, and from then on it continued within the normal range until his discharge, on the twenty-sixth hospital day. The cough was paroxysmal and productive of a thick yellowish sputum. At times after meals, the cough was followed by vomiting.

On the sixth hospital day shallow but large ulcers were found on the anterior two thirds of the right ventricular fold and on the anterior two thirds of both vocal cords. The nasal ulcers remained unchanged.

On the eighth hospital day all lesions of the upper respiratory tract were definitely worse. In addition, there was superficial punctate staining of the epithelium of the left cornea. Ulceration of the larynx had progressed so that both ventricular and true cords were completely involved. On the twelfth day a purulent discharge developed from both middle meatuses. Roentgenograms showed cloudiness of both antrums. Pus was obtained on irrigation. On the fourteenth hospital day the upper respiratory tract appeared normal except for mild diffuse inflammation. On the twentieth day his hoarseness disappeared. On the twenty-third hospital day the upper respiratory tract and eyes appeared normal.

Although the sedimentation rate was abnormally elevated, the patient was discharged on the twenty-sixth hospital day to convalescent leave.

### REPORT OF A REPRESENTATIVE CASE OF LIQUID BURN

H. C. W., a second lieutenant, a white man aged 25 years, was admitted to the hospital on March 8, 1943.

The family history and past history were noncontributory.

*History of Present Illness.*—At 7 p. m. on March 6, 1943, this officer became aware of a burning of his right upper eyelid. He was unable to recall any unprotected exposure. He promptly washed thoroughly with soap and water.

Fifteen hours later he reported to the eye clinic, with swelling of the right upper eyelid. There was no vesiculation. The eye itself appeared normal.

Twenty-four hours after the onset of symptoms small vesicles were noted on the right upper eyelid and the right side of his face. The vesicles contained clear

straw-colored fluid. Edema was present, but there was no erythema or pigmentation. The vesicles were painful although superficial. The vesicles were débrided and a water-soluble base, 5 per cent sulfadiazine ointment, applied.

Twenty-four hours later the patient was admitted to the hospital. At this time the epithelium of the cornea of the right eye was edematous (retroillumination) but failed to stain with fluorescein. Miosis (2 mm.) of the right pupil was evident (the left pupil under the same illumination measured 4 mm.). The iris vessels of the right eye were definitely engorged, and the pupil reacted sluggishly to light. All conjunctival vessels were injected with some laking and early small conjunctival hemorrhages.

*Clinical Course.*—The pupil of the right eye dilated readily after repeated instillations of homatropine hydrochloride. The cutaneous burns healed slowly, without infection.

On the third hospital day the cornea and iris appeared normal. The patient was discharged and referred to the eye clinic for follow-up observation.

## SUMMARY

The clinical findings on 8 casualties from exposure to a nitrogen-mustard (1149) vapor are analyzed. This is a relatively unknown gas developed during World War II. Clinical experience was meager.

Representative case histories of a vapor and of a liquid burn are presented.

The commonest complaint pertaining to the upper respiratory tract was hoarseness, and the commonest lesion was diffuse inflammation, frequently spotted with necrotic ulcers of grayish slough. It is supposed that these ulcers were due to the necrotizing action of the gas per se, but they may have been the result of bacteria acting on devitalized tissue. That the latter surmise was true to a certain extent was evidenced by the fact that 62 per cent of the casualties were febrile and coughed up a purulent sputum and that in 1 casualty an acute bilateral antritis developed. The antral infection may have been chance.

The most frequent eye complaint was a burning sensation, characterized on examination by conjunctival injection and superficial punctate keratitis.

Symptoms of acute esophagitis and gastritis were an interesting observation in that they may have been due to the swallowing of contaminated air (see report of case D. J. T.). The assumption that swallowing contaminated air can cause an acute inflammatory reaction in the mucosa of the esophagus and stomach could and should be easily substantiated or disproved experimentally. On the other hand, this symptom was more likely the result of a reflex phenomenon induced by general toxicity or an inflammatory lesion in the upper respiratory and/or digestive tract.

Under the conditions of these accidents, the mucosa of the upper respiratory and digestive tracts and the conjunctiva appeared to be equally sensitive to the vapor of this gas.

# TESTING THE HEARING OF NEWBORN INFANTS

EMIL FROESCHELS, M.D.
NEW YORK
AND
HELEN BEEBE
EASTON, PA.

SOME forty years ago a series of observations by Liebmann [1] disproved the opinion that all children are born deaf. This supposition had been generally accepted and was expressed by authors such as J. Meyer.[2] Others, among them Alexander,[3] were of the opinion that newborn infants had a certain hearing capacity.

> The ability of hearing in the new born is very deficient. The external auditory meatus is not permeable, and the spaces of the middle ear are nearly filled with gelatinous tissue. The surface of the tympanic membrane is uneven and the membrane itself is thick. . . . Sound conduction is, therefore, considerably interfered with in both the external and middle ear. Such an impediment occurring in the adult from disease conditions would considerably diminish the auditory acuity, reducing it to perhaps one or two meters in ordinary conversation and this distance will probably represent the auditory acuity of the newborn. . . .[4]
>
> Motor reaction upon sound perception in the newborn has been demonstrated during the first two weeks, the earliest time being the fourth day. (Preyer)

Canestrini [5] registered changes of the intracranial pressure of extremely young infants on acoustic (and visual) stimuli. He considered the increase of pressure a sign of perception of the stimuli. Recently I. R. and A. W. G. Ewing [6] have reported on the responses of extremely young children to noises and voice. These studies do not include babies in the first weeks of life. At the end of the first and in the second and third months, the children they tested responded more quickly to percussion sound than voices. "As a rule . . . blink-

1. Liebmann, A.: Vorlesungen über Sprachstörungen, Berlin, O. Coblentz, 1900.

2. Meyer, J.: Weitere Beiträge zur Frage der Schallokalisation, Monatschr. f. Ohrenh. **46**:449, 1912.

3. Alexander, G.: Diseases of the Ear in Childhood, translated by A. J. Bedell, ed. 2, Philadelphia, J. B. Lippincott Company, 1917.

4. According to our table Alexander overrated the hearing capacity of newborn infants.

5. Canestrini, S.: Ueber das Sinnesleben der Neugeborenen, Berlin, Julius Springer, 1913.

6. Ewing, I. R., and Ewing, A. W. G.: The Ascertainment of Deafness in Infancy and Early Childhood, J. Laryng. & Otol. **59**:309 (Sept.) 1944.

ing, screwing up of the eyes, involuntary jumping, twitching of fingers, turning (even in sleep) towards his nurse resulted." Some children appeared to ignore a sound after two or more repetitions.

The small number of patients tested and especially the lack of information about the acoustic reaction of infants in the first week of life seemed to justify this study. Our purpose was to determine the acoustic reaction of babies in the first few days of life. Naturally, an audiometer test was out of the question.

Our experience with hard of hearing and deaf children suggested the use of Urbantschitsch's whistles. This set of whistles is comprised of thirty-five whistles, namely, seven octaves, tones from T-1 to f-4.

The usefulness of these whistles for testing older children has been described in several publications of Froeschels.[7] Many children who are severely hard of hearing react to loud noises only. However, the development of speech depends on the capacity to hear tones. Older children and some as young as 18 months had reacted to the Urbantschitsch whistles with blinking, grimaces, body withdrawal, turning toward the source of sound and expression of pleasure or pain.

It remained to be seen whether newborn infants would also react to this kind of acoustic stimulation. In addition to the whistles, we also used four tuning forks, of 128, 256, 2,048, 4,096 double vibrations respectively. As a rule the baby lay in his cradle or on a bed. In exceptional cases, when the child slept or did not react to the acoustic stimuli, the nurse held him. As infants could not stand being tested with the complete set of whistles, we used only three or four in a single case. However, different whistles were used with different groups of babies in an attempt to make up for the small number of whistles used with a single group. The tuning forks (ad concham) were used only in 10 cases. As not 1 of the 10 infants reacted to the tuning forks while 9 of them reacted positively to the whistles, we considered it unnecessary to continue the tuning fork test.

A total of 33 patients[8] between the ages of one-half and nine days was examined. The results of these observations are shown in the table. The following conclusions can be drawn from the table: Tuning forks are not a means of testing the hearing of newborn infants. Blinking (acoustopalpebral reflex) is the most frequent reaction shown by newborn infants. Jerking movements and shrinking or turning

7. (*a*) Froeschels, E.: Psychic Deafness in Children, Arch. Neurol. & Psychiat. **51**:544 (June) 1944; (*b*) Testing of the Hearing of Very Young Children, Arch. Otolaryng., to be published.

8. The administration and the heads of the obstetric departments of Beth Israel Hospital, New York, and the Easton Hospital, Easton, Pa., gave their permission to examine a number of newborn infants. We were restricted to hearing examinations without otoscopic proceedings.

| Case | Sex | Age, Days | Physical Condition | Reaction to Tuning Forks | Pitches and Greatest Distance at Which Baby Reacted to Whistles with Blinking Reflex | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | F | ½ | Normal | | c-4 2 ft. | f-2 3 ft. | e-1 | c-0 | Strong blink and body jerk to f-2 (ad concham) |
| 2 | F | 1 | Normal | — | d-0 | d-1 5 in. | f-2 | h-2 | Lifted arm to f-2 (ad concham); fast asleep during test |
| 3 | F | 1 | Normal | — | d-0 | d-1 8 in. | f-2 8 in. | h-2 8 in. | Turned head toward source for f-2; fast asleep during test |
| 4 | F | 1 | Normal | — | d-0 | d-1 4 in. | f-2 | h-2 | Slight movement of head for h-2 (ad concham); shrinking to d-1; fast asleep during test |
| 5 | M | 2 | Normal | | c-4 4 ft. | f-2 10 ft. | c-1 3 ft. | c-0 | |
| 6 | F | 3 | Normal | | c-4 3 ft. | c-2 3 ft. | c-1 3 ft. | c-0 | |
| 7 | F | 3 | Normal | | c-4 4 ft. | c-2 8 ft. | c-1 4 ft. | c-0 | |
| 8 | F | 3 | Normal | | c-4 3 ft. | f-2 3 ft. | c-1 3 ft. | c-0 3 ft. | |
| 9 | M | 3 | Normal | | c-4 | f-2 20 in. | c-1 | c-0 | |
| 10 | M | 4 | Normal | | c-4 | f-2 1 ft. | c-1 | c-0 | Baby was squinting so it was difficult to be sure of reaction to other whistles |
| 11 | F | 4 | Normal | — | g-0 3 in. | g-1 3 in. | c-4 3 in. | ... | Looking toward source |
| 12 | M | 4 | Normal | — | g-0 4 in | g-1 4 in. | c-4 4 in. | | |
| 13 | M | 4 | Normal | | c-4 4 ft. | f-2 11 ft. | c-1 3 ft. | c-0 | |
| 14 | F | 4 | Normal | | c-4 3 ft. | f-2 3 ft. | c-1 3 ft. | c-0 | |
| 15 | F | 4 | Normal | | c-4 2 ft. | f-2 2 ft. | c-1 | c-0 | |
| 16 | M | 4 | Normal | | c-4 3 ft. | f-2 3 ft. | c-1 3 ft. | c-0 | |
| 17 | M | 4 | Normal | | c-4 | f-2 3 ft. | c-1 3 ft. | c-0 | |
| 18 | M | 5 | Normal | — | g-0 8 in. | g-1 8 in | c-4 8 in. | | |
| 19 | M | 5 | Normal | — | d-0 | d-1 18 in. | f-2 20 in. | h-2 40 in. | Shrinking to f-2 and h-2 (ad concham) |
| 20 | M | 5 | Normal | — | d-0 | d-1 | f-2 | h-2 | (Ad concham) |
| 21 | F | 5 | Normal | | c-4 | f-2 2 ft. | c-1 | c-0 | |
| 22 | F | 5 | Normal | | c-4 | f-2 | c-1 | c-0 | Cesarean delivery; 5 days premature |
| 23 | M | 5 | Normal | | c-4 | f-2 18 in. | c-1 | c-0 | Single response |
| 24 | M | 5 | Normal | | c-4 | f-2 2 ft. | c-1 | c-0 | Single response |
| 25 | F | 6 | Normal | | c-4 | f-2 5 ft. | c-1 5 ft. | c-0 | |
| 26 | M | 6 | Normal | | c-4 | f-2 2 ft. | c-1 | c-0 | |
| 27 | F | 7 | Normal | — | g-0 3 in. | g-1 3 in. | c-4 3 in. | | |
| 28 | M | 7 | Normal | | c-4 | f-2 4 ft. | c-1 3 ft. | c-0 | |
| 29 | F | 7 | Normal | | c-4 4 ft. | f-2 4 ft. | c-1 4 ft. | c-0 | |
| 30 | M | 8 | Normal | — | g-0 3 in. | g-1 3 in. | c-4 3 in. | ... | Looking toward the source |
| 31 | F | 8 | Normal | | c-4 3 ft. | f-2 3 ft. | c-1 3 ft. | c-0 | |
| 32 | M | 8 | Normal | | g-0 4 ft. | f-1 5 ft. | g-2 4 ft. | c-4 2 ft. | Shrinking to g-0, f-1 and g-2; looking toward the source |
| 33 | M | 9 | Normal | | c-4 4 ft. | f-2 4 ft. | c-1 4 ft. | c-0 | |

toward the source are less frequent reactions. Despite the few negative reactions it is evident that the whistle test proves the presence of hearing in the great majority of newborn infants.

The fact that there were no reactions to the tuning forks may be due to the relatively weak sounds they produce as compared with the much stronger tones of the whistles. Yet it is worth considering that the negative response to the tuning forks in contrast to the positive response to the whistles could be due to the different centers involved.

The tuning forks lacking overtones logically appeal to another center than the one appealed to by the compound tones of the whistles. Although the question as to which of the acoustic centers are related to pure tone perception and which to the perception of compound tones is not answered, it seems probable to us that Heschl's centers have to do with the former while the acoustic musical center in the second left temporal convolution and Wernicke's center in the third have to do with the latter.

According to de Crinis,[9] all these centers are developed at birth. Nevertheless, a difference in maturity may exist.

The question whether a negative reaction to a single tone or compound tone indicates a lack of perception—in other words, deafness to it—cannot be answered now. No reaction to any of the whistles used can be considered a failure of perception, especially since we tested these patients several times, with the same result. Whether this lack of perception is permanent remains to be seen. We intend to test these patients again.

It is especially worth noting that some of our patients moved the eyes and some the head toward the source, although some writers have stated the belief that searching for the source of sound starts much later in infancy.

As the test is simple and does not harm the examinee, we suggest that it should be generally introduced. If repeated at monthly intervals, it may help to detect hearing impairment early in life.

There is also the possibility of determining the onset of deafness. Frequently, when there is a diagnosis of deafness or hardness of hearing in a child in his first, second or third year, the parents and the physician may not know whether the defect is congenital or acquired. Regular hearing tests correlated with the childhood history — medical and environmental—might prove to be a contribution to medical research on the causes of deafness.

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9. De Crinis, M.: Die Entwicklung der Grosshirnrinde nach der Geburt in ihren Beziehungen zur intellektuellen Ausreifung des Kindes, Wien. klin. Wchnschr. **45**:1161, 1932.

The greatest benefit to be derived from discovering with these tests any hearing impairment early in life is that countermeasures can be taken immediately. Recommendations for early therapy have been described in the literature.[10]

## SUMMARY

1. The whistle test previously recommended for children has been used to test newborn infants.

2. Of 33 infants, 31 reacted positively.

3. In contrast to the whistles, no reaction could be obtained with tuning forks.

4. The acoustopalpebral reflex is the most frequent reaction.

5. Some of the examinees moved the eyeballs and some the head toward the source.

6. The whistle test proved the presence of hearing in the great majority of newborn infants.

7. It is suggested that the test be generally used in order to detect hearing impairments at an extremely early age, thus making it possible to introduce therapy as soon as possible.

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10. Ewing and Ewing.[6] Froeschels.[7b]

# Progress in Otolaryngology

**Summaries of the Bibliographic Material Available in the Field of Otolaryngology**

## CONTRIBUTIONS TO PLASTIC SURGERY DURING 1945

LYNDON A. PEER, M.D.
NEWARK, N. J.

A REVIEWER, in my opinion, has two obligations: one to the author of the article and the other to its potential reader. When conclusions drawn by the author appear at variance with the factual evidence or when the subject is controversial, the reviewer should indicate by objective editorial comment how and to what extent the opinion expressed in the article differs from the generally accepted beliefs of other plastic surgeons.

An article which expresses opinions contrary to those held by the reviewer, however, is in the nature of a tasty morsel which tempts him to dip his quill and write a strong denial based on personal experience. This may be unfair to some authors in that their work is judged and criticized without the opportunity for rebuttal.

In this review I will first express my personal views regarding certain practices in plastic surgery and then proceed to the usual summary of the current literature.

### EDITORIAL COMMENT ON CURRENT TRENDS IN PLASTIC SURGERY

I wish to call the attention of otolaryngologists to a generally accepted policy which has no basis in fact. This policy is the old rule copied from textbook to textbook, without critical evaluation, and more rigidly observed than any of the Ten Commandments: Never operate on a fractured nose until the patient is 17 years old, because surgical intervention to correct the deformity will inhibit or "stunt" normal growth of the nose. The absurdity of this rule may be recognized by application of it to a fracture of the humerus in an infant or child in whom the fractured ends of the bone overlap and have healed in a distorted position. Any competent orthopedist knows that if the humerus is refractured and the ends of the bone placed in proper position the arm will develop more normally. The same rule applies to old fracture displacement of the bony nasal arch and the nasal septum. The members of my department have refractured and set many traumatic and congenital deformities of the nose in infants and small children,

and inhibited growth of the nose has not been observed in any of these patients. On the contrary, the corrected nose develops more normally, and a later plastic operation, at the age of 17 years, is usually obviated. Large portions of the nasal septum should not be removed, but hinging or removal of small portions of septal cartilage to repair displacements does not retard growth.

A few articles appear each year regarding the management of "nose conscious" persons and the importance of an artistic viewpoint in order to obtain a satisfactory repair. Some are rather fanciful, but others contain sound advice. One should always bear in mind that the patient desiring a nasal plastic operation presents a psychic as well as a surgical problem and that the success of operation depends entirely on the patient's reaction to the altered nose. Often this reaction will be influenced by the opinion of the patient's mother, who is critical of any radical change. In general, one should determine that a reasonable degree of improvement, safely underestimated, will satisfy the patient, and if this is not acceptable the best policy is to advise against operation. The occasional operator will find it expedient to avoid radical alteration of the nasal structure. This is particularly true in many cases of developmental abnormality in which the nose often has a sort of overemphasized but balanced symmetry with the facial structure. In such instances it is wise "to remove the overemphasis but to retain the balance." The best end result following rhinoplasty is a nose in harmonious relationship with the face and a nose which does not look as though it had been operated on. The pinched, narrow nose with notched alae is always the result of radical operation in inexperienced hands.

There appears to be a current trend to publicize various agents which are claimed to cement skin grafts to recipient sites and increase the percentage of successful takes. These so-called physiologic cements have been widely heralded and enthusiastically used by many prominent surgeons. Most of these agents are as harmless as isotonic solution of sodium chloride aside from the fact that they beguile the operator and tend to make him neglectful of the important factors which actually determine the success or failure of skin grafts. A few of the agents are, in fact, harmful. At a panel discussion on this subject in a recent national society meeting, cell extracts, thrombin, plasma and even agar were all advocated by various men as suitable agents to cement skin grafts to recipient sites and insure successful takes. The chairman closed a somewhat lengthy and heated discussion with the following statement: "Gentlemen, it is clear that the skin is a hardy structure. Skin grafts will take in spite of everything you do to them.

The use of thrombin has been advocated by a number of experienced surgeons for the control of bleeding on recipient sites. The theory

regarding the topical action of thrombin appears sound, but in my hands the application has been disappointing. I cannot correlate my results with those reported in the literature.

The so-called inert metals vitallium and tantalum are foreign bodies which appear to be well tolerated by human tissues. They have a definite place in operation as temporary supports, but the reaction of the tissues to their presence over long periods has not as yet been determined. Foreign bodies which are initially inert may not necessarily remain inert. Vitallium and tantalum supports for the repair of saddle nose and for the framework of reconstructed auricles have shown a tendency to work through the overlying skin.

A new surgical publication *Plastic and Reconstructive Surgery* appeared in July 1946. The publishers are Williams & Wilkins Company, of Baltimore, and the editor is Dr. Warren B. Davis, of Philadelphia, who is assisted by a group of ten associate editors in different sections of the country. The organizing and issuing of this journal, which is the first of its kind, represents a landmark in the development of plastic surgery. Otolaryngologists interested in rhinoplastic procedures and general facial plastic surgery will undoubtedly find this journal both helpful and stimulating.

### EXPERIMENTAL AND CLINICAL INVESTIGATION

On the basis of experimental work, Young[1] concludes that costal cartilage can be transplanted from one dog to the subcutaneous tissues of another dog and still remain viable in its new location up to one and one-half years. On removal it was found that the transplants were firmly attached to the soft tissues without noticeable neighboring inflammatory or fibrotic reaction, and they retained their cartilaginous appearance and springlike physical properties. All the recovered transplants were sectioned and examined microscopically. The author states the belief that if the presence of normal cartilaginous architecture is a criterion then one can state without hesitation that these cross transplants remain viable.

(*Comment.*—Living human isogenous cartilage grafts also seem to retain their cartilaginous structure following transplantation in many cases. Microscopic examination shows normal-appearing cartilage cells and matrix, but there is a pronounced tendency to gradual slow invasion of the grafts by connective tissue. Occasionally the grafts remain in place for some time and then rather suddenly undergo rapid absorption. Our impression is that living isogenous cartilage grafts are not superior to preserved cadaver cartilage grafts in human beings. Both are inferior grafting materials when compared with the patient's own rib cartilage.)

1. Young, F. F.: Homogenous Cartilage Grafts, Surgery **17**:616 (April) 1945.

Rogatz and Davidson [2] describe a case of congenital defect of the skin in a newborn child. The infant was perfectly formed except for numerous areas of absence of skin on the scalp, neck and extremities. The missing skin in all areas was replaced by a thin moist, glossy, transparent membrane, through which the underlying vessels and joints were clearly visible. The authors review the literature on this subject and state that a congenital defect of the skin in infants is a comparatively rare occurrence, about 125 cases having been reported, the majority of these being cases of lesions of the scalp. Though areas of deficiency or absence of skin may occur singly and anywhere on the body, it is usual for them to be bilateral and to be symmetric in size, shape and appearance. Occasionally other abnormalities are associated with defects of the scalp, such as coexisting harelip, cleft palate, deformities of the fingers and polydactylism. The cause of the condition is not known.

In a discussion of congenital ectodermoses in infancy, Kahn[3] stated that these conditions are of interest not only to the pediatrician but also to the obstetrician, neurologist and dermatologist. Café au lait spots and multiple neurofibromatosis may be associated with lowered mentality, although this condition is also seen in patients of apparently normal mentality. Less constant is the presence of "port wine" nevus in patients with von Recklinghausen's neurofibromatosis. Weber expresses the opinion that the nevus anemicus of Vorner and " 'port wine' nevus are neurogenic in nature and secondary to a congenital defect in the vasomotor innervation causing a permanent vasospasm in the former and a permanent vasodilatation in the latter."

(*Comment.*—The group of congenital ectodermoses in infancy is also of interest to the plastic surgeon and to the psychiatrist, since their services may be required to remove or lessen the deformity and to adjust the child to an acceptable mental compromise with the condition.

Congenital ectodermal dysphasia is an interesting example of a congenital ectodermosis which may require the services of various specialists working together.)

Penhale [4] discusses the use of acrylic resin implants and cautions that they may produce late inflammatory changes. In the author's experience with this material over a period of about three years, no patients had untoward clinical effects. However, not until such an implant has been embedded for ten or twenty years is one prepared to state the final outcome.

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2. Rogatz, J. L., and Davidson, H. B.: Congenital Defect of the Skin in the Newborn, Am. J. Dis. Child. **65**:916 (June) 1943.

3. Kahn, B. L.: The Congenital Ectodermoses in Infancy and Childhood, Arch. Pediat. **61**:150 (March) 1939.

4. Penhale, K. W.: Acrylic Resin as an Implant for Correction of Facial Deformity, Arch. Surg. **50**:233 (May) 1945.

The high mortality rate from operation on patients in shock may be ascribed to hemorrhage, to the operative manipulations or to the anesthesia, according to Crooke and his colleagues.[5] Patients in traumatic shock with significant alteration in plasma volume suffered a definite fall in blood pressure, due to the anesthetic. Ether or ether and chloroform caused the severest fall. Pentothal sodium acted in a manner similar to ether. However, cyclopropane and oxygen usually increased the blood pressure except in severely shocked patients.

Powers [6] notes that rest as a therapeutic measure is fraught with hazard. Prolonged periods of recumbency in bed are anatomically, physiologically and psychologically unsound and unscientific. Surgical wounds heal firmly even though early postoperative activity is encouraged.

The importance of physical therapy for patients undergoing plastic operations is emphasized by Reidy.[7] Before an operation, measures can be taken to improve the circulation of a tubed pedicle previous to transference or to improve the circulation in indolent granulating areas. After an operation, in all types of grafts treatment may be given to reduce the degree of contracture and to improve the circulation and the appearance of suture lines.

The treatment of postirradiational ulcers, which are constantly being observed in radiotherapeutic and plastic surgery clinics, in the past constituted a difficult and disturbing problem. The adoption by Cooper and Robertson [8] of the application of radon-impregnated petrolatum, as outlined by Uhlmann, has solved the problem at the Brisbane General Hospital in all cases except those in which the ulcers are due to overdosage. It is the authors' impression that the alpha rays in small doses stimulate and promote the growth of vascular epithelial structures.

In a special article, Lund and Levenson [9] emphasize that the correction of protein deficiencies is of importance in shock, in local or general hypoproteinemic edema, in wound healing, in immunity to infection and in detoxication of poisonous substances. The methods of treatment include the use of whole blood, plasma and albumin for acute deficiencies such as hemorrhagic shock and of protein hydrolysates, concentrates and diets for less acute and for chronic deficiencies.

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5. Crooke, A. C.; Morris, C. J. O. R., and Bowler, R. G.: General Anesthesia in Shock, Brit. M. J. **2**:683 (Nov. 25) 1944.

6. Powers, J. H.: The Abuse of Rest as a Therapeutic Measure in Surgery, J. A. M. A. **125**:1079 (Aug. 19) 1944.

7. Reidy, J. P.: The Relation of Physiotherapy to Plastic Surgery, Proc. Roy. Soc. Med. **37**:705 (Oct.) 1944.

8. Cooper, A. G. S.: The Treatment of Postirradiational Ulcers by Radon Ointment, M. J. Australia **1**:297 (March 24) 1945.

9. Lund, C. C., and Levenson, S. M.: Protein in Surgery, J. A. M. A. **128**: 95 (May 12) 1945.

An interesting editorial in *The Journal of the American Medical Association* emphasizes that, with increasing knowledge of the interactions of vitamins, the possibility of vitamin imbalance must be considered. Indiscriminate administration of large amounts of individual members of the B complex, particularly thiamine hydrochloride, may lead to deficiencies of other vitamins. The addition of vitamins, as in the fortification of foods, should also be considered in regard to the possibility of vitamin imbalance.[10]

Neivert [11] reports on the effect of the administration of acetylsalicylic acid or salicylates on patients who have had a tonsillectomy performed. These drugs produce a reduction in the prothrombin level of the blood, which predisposes the patients to late post-tonsillectomy hemorrhage. The simultaneous administration of a vitamin-K-like compound (synkayvite) prevented the prothrombin-lowering effect of the acetylsalicylic acid, thus allowing normal coagulation to take place.

In a discussion of the fluid and nutritional therapy of burns, Harkins and colleagues [12] stress the importance of the extent of a burned body surface in determining the necessity for intensive fluid therapy.

Following damage to the skin by a burn, there is a loss of extracellular fluid, including salts and plasma proteins, both into the burned area itself and as a discharge from any denuded surface. With this fluid loss there will be dehydration, a decrease in the circulating plasma volume and hemoconcentration (i. e., apparent increase in the number of red cells in the whole blood).

In mild burns spontaneous ingestion of fluids and food according to the desires of the patient is usually adequate, but in severer injuries special methods of therapy are necessary to aid convalescence and to save lives. The authors go on to say that it is generally agreed that in burns which involve less than 10 per cent of the body surface there is not sufficient loss of extracellular fluid to warrant intensive fluid therapy.

A point in the therapy of local burns which has been raised lately is whether or not a lesion should be debrided prior to the onset of definitive therapy. To answer this question, Dingwall and Andrus [13] purposely left five lesions with vesicles intact and covered this area with sulfonamide film. Contralateral areas were debrided as usual and treated with the same agent. All lesions were healed in seven days, and comparison

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10. Vitamin Imbalance, editorial, J. A. M. A. **129**:74 (Sept. 1) 1945.

11. Neivert, H.: Late Secondary Tonsillar Hemorrhage (Studies of Prothrombin and Vitamin K), Arch. Otolaryng. **42**:14 (July) 1945.

12. Harkins, H. M.; Cope, O.; Evands, E. I.; Phillips, R. A., and Richards, D. W., Jr.: The Fluid and Nutritional Therapy of Burns, J. A. M. A. **128**:475 (June 16) 1945.

13. Dingwall, J. A., and Andrus, W. deW.: A Comparison of Various Types of Local Treatment in a Controlled Series of Experimental Burns in Human Volunteers, Ann. Surg. **120**:377 (Sept.) 1944.

of the new epithelium of the two sides showed little difference. In three instances, the blister was still imperforate and the fluid had been reabsorbed while the lesion healed.

In working with animals, Peterson [14] noted that the harmful effect of mechanical washing of wounds is in direct proportion to the coarseness of the material used. He concludes that the cleansing of contaminated wounds by gentle irrigation with isotonic solution of sodium chloride is the most effective prophylaxis of wound infection.

Meleney [15] made a study and appraisal of the use of sulfonamide drugs as preventives against wound infection. He draws the conclusion that the use of sulfonamide compounds either systemically alone or locally alone or combined has not materially reduced the incidence or the severity of local infections in the wounds or burns; nor have they delayed the development of infection, nor have they eliminated the pathogenic organisms from the wounds. It seems likely, however, that they have minimized the spread of the local infection into the general circulation and have therefore diminished the incidence of septicemia and death.

From an experimental study, Lovell [16] concludes that most of the transient organisms of the skin are superficial and can be removed by mechanical and chemical cleansing. The resident bacteria, however, are situated so deeply in the hair follicles and sebaceous glands that they cannot be removed by mechanical means without injuring the skin; the generally used antiseptics do not penetrate sufficiently to reach the organisms located in the deeper layers of these structures. Although the surface of the skin may be rendered relatively free from bacteria by mechanical and chemical cleansing before operation, during operation the resident bacteria rise to the surface, multiply and thus constitute an important source of wound contamination.

On the basis of experimental work with human beings, Posch and his associates [17] conclude:

> It is evident that sulfanilamide and sulfathiazole act as irritants to the dermis and the subcutis. In addition, they may produce focal areas of necrosis and marked leukocytic response in the adjacent tissues. However, the deleterious effects are short-lived and are not evident in wounds 7 to 10 days old. Subsequent healing is prompt and within normal limits.

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14. Peterson, L. W.: Prophylaxis of Wound Infection: Studies with Particular Reference to Soaps and Irrigation, Arch. Surg. **50**:177 (April) 1945.

15. Meleney, F. L.: A Study of the Prevention of Infection in Wounds, Surg., Gynec. & Obst. **80**:263 (March) 1945.

16. Lovell, D. L.: Skin Bacteria: Their Location with Reference to Skin Sterilization, Surg., Gynec. & Obst. **80**:174 (Feb.) 1945.

17. Posch, J. L.; Maun, M. E.; Pilling, M. A., and Hirshfeld, J. W.: The Effect of Sulfanilamide and Sulfathiazole on Human Tissues, Surg., Gynec. & Obst. **80**:143 (Feb.) 1945.

Evans and associates [18] treated a series of burned patients with sulfonamide drugs in ointments with an oil base and a water-dispersible base. Their studies indicate that the absorption of sulfonamide compounds from the burned surface is limited when ointments with an oil base are employed. In contrast, when a water-dispersible base is used toxic blood levels of the drug may occur. Results of studies on burned patients indicate that sulfonamide ointments with an oil base can be employed with safety; their use has been attended with gratifying results, the incidence of infection being low.

Careful bacteriologic determination of penicillin sensitivity of the infecting bacteria should always precede actual treatment, in the opinion of Fisher.[19] When the infection is deeper, the combination of local and systemic use of penicillin or its employment supplemented by sulfonamide drugs or tyrothricin may be advisable. These drugs are compatible in combinations. The local application of penicillin for a localized infection appears more economical and efficient provided the lesion is open and the infection not too deep. However, general surgical principles, such as drainage of pus, removal of sequestrums and excision of dead tissue, must not be neglected.

Burke and his co-workers [20] have demonstrated adequate penicillin blood levels following oral administration when the drug was protected from the inactivating effect of hydrochloric acid in the stomach. No objective or subjective symptoms of toxicity were observed after single doses of 100,000 and 200,000 units of penicillin orally.

On the basis of animal experimentation, Pfeiffer and his associates [21] conclude that boric acid, whether applied in the form of an ointment or as a saturated solution to extensive wounds, is a cumulative poison. Its weak antiseptic value suggests that for medicinal use other more active and less potentially harmful therapeutic agents should be employed.

### SKIN GRAFTING

In an excellent article on the principles of skin grafting, Ivy [22] advises the use of intermediate thickness grafts for superficial losses when little or none of the subcutaneous tissue is lost. With modern

18. Evans, I. E.; Hoover, M. J., and Watson, J. G.: The Absorption of Sulfonamides from the Burned Surface, Surg., Gynec. & Obst. **80**:297 (March) 1945.

19. Fisher, A. M.: The Therapeutic Value of Penicillin Applied Locally, Based on Experience with the Crude Material in a Variety of Infections, Bull. Johns Hopkins Hosp. **76**:134 (March) 1945.

20. Burke, F. G.; Ross, S., and Strauss, C.: Oral Administration of Penicillin, J. A. M. A. **128**:83 (May 12) 1945.

21. Pfeiffer, C. C.; Hallman, L. F., and Gersh, I.: Boric Acid Ointment Intoxication, J. A. M. A. **128**:266 (May 26) 1945.

22. Ivy, R. H.: Principles of Skin Grafting, Clinics **3**:1623 (April) 1945.

methods of cutting large skin grafts, the size of the area to be covered makes little difference. The use of a free graft usually means a single operation only for a given area, whereas the transfer of a flap requires three or four operations, at intervals of three or four weeks. On the other hand, pedicle flaps have a high resistance to infection, possess some thickness for filling out defects in contour and undergo little subsequent contracture. The skin of a flap is also soft and pliable, and the color remains normal for the part from which it has been removed. Where tendons, important nerves and bone are exposed, a flap with its subcutaneous fat is superior to a graft.

In Greeley's opinion,[23] the present military conflict has given rise to a wide group of traumatic lesions which ultimately are treated by the plastic surgeon. For a long time he has advocated using "a properly selected type" of skin graft for the correction of a given deformity. This phrase implies that a certain amount of thought and consideration based on experience should be given to the problem of repair. In covering extensive granulating defects, Greeley recommends the use of thin split thickness grafts. To employ "pinch" and "flagstone" grafts is not advisable except in a few cases in which adequate donor areas cannot be found from which to take large sheets of skin. He does not use skin from other persons, since these isografts will not remain as a permanent covering. The Sano coagulum contact method of skin grafting is not recommended. When split thickness grafts are applied, a natural coagulum develops rapidly between the raw surface of the graft and the underlying granulating bed, which causes the graft to adhere.

Cannaday,[24] who has been using cutis grafts (dermal grafts) since 1940, has found increasing indication for application of the method. In all, a total of 86 cases are reported. Cutis transplants may take the place of fascia lata whenever and wherever indicated and, in general, give more satisfactory results. The cutis graft may be used to replace destroyed dura, to reenforce or replace the ligaments of joints, to restore the lining of joints (ankylosis of the mandible), to reenforce the walls in aneurysms in case of impending rupture and to restore normal contour to the nose, lips and face.

Cannaday's technic is as follows: After the skin has been prepared by application of iodine and then alcohol, a thin layer is removed with a skin graft knife or safety razor blade. The segment of exposed cutis is then excised with the scalpel. If the defect is extensive, it may be covered by the sheet of epidermis removed from the cutis. Whenever possible, the wound edges are united by direct suture.

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23. Greeley, P. W.: Current Experience in Plastic Surgery Among Naval Personnel, Am. J. Surg. **67**:257 (Feb.) 1945.

24. Cannaday, J. E.: An Additional Report on Some of the Uses of Cutis Graft Material in Reparative Surgery, Am. J. Surg. **67**:238 (Feb.) 1945.

Brown and Cannon[25] recommend full thickness skin grafts from the neck and clavicular regions for use in repair of the eyelid and face, because of their superior qualities for color matching and function. There is a natural redness in these grafts not found in other skin, and their thickness and softness permit good function of the underlying muscles. Late function is excellent, since there is minimal contracture of the graft bed when these grafts are used. The grafts are set in place accurately with interrupted sutures of light silk, and the ends of the sutures are left long for subsequent fixation over a waste form. No holes are cut in the graft; it is covered with fine mesh greased gauze, over which a wad of white cotton or waste is carefully packed. Appropriate opposite pairs of sutures are then tied firmly over the cotton or waste as the assistant compresses the form with his fingers or instruments. The donor site may be closed or partially closed and partially left open or covered with a split graft.

According to King,[26] through the use of skin grafts many open wounds can be converted into closed wounds and thus primary healing obtained. For success in the method all dirty wounds must be surgically clean before grafting is attempted. Grafts must be placed and held in firm apposition with the underlying tissues. The commonest causes of failure in skin grafting are: (1) infection, (2) the presence of blood or serum pockets beneath the graft, (3) inadequate contact between the graft and its bed and (4) improper or inadequate anchorage of the graft, so as to allow movement during the healing period.

Large areas that have been deeply burned should be covered with skin grafts at the earliest opportunity, as pointed out by McCorkle and Silvani.[27] It is necessary, however, to wait until shock, alterations in body proteins, fluid and electrolyte balance, renal function, edema and "toxemia" have been controlled. It is also desirable to wait until the epithelium has been restored spontaneously to all areas of second degree burns. To wait for epithelization of large full thickness defects, however, even though they contain small viable epithelial islands that eventually might spread to cover the area, is usually unwise. Grafting should be done early to avoid the period of debilitation so often associated with the presence of large granulating areas several weeks after a burn has occurred. Maintenance of nutrition, with particular reference to a diet

25. Brown, J. B., and Cannon, B.: Full-Thickness Skin Grafts from the Neck for Function and Color in Eyelid and Face Repair, Ann. Surg. **121**:639 (May) 1945.

26. King, M. K.: Immediate Skin Grafting Following Injuries, Surg., Gynec. & Obst. **81**:75 (July) 1945.

27. McCorkle, H. J., and Silvani, H.: Selection of the Time for Grafting of Skin to Extensive Defects Resulting from Deep Thermal Burns, Ann. Surg. **121**:285 (March) 1945.

high in protein and vitamin C, is essential, especially if early skin grafting is contemplated.

As pointed out by Webster,[28] by the removal of scar tissue and the replacement of lost substance with normal skin and fat brought to a defect by means of a pedunculated flap, many varieties of defects, whether facial or otherwise, can be corrected. However, certain sound principles must be understood before these flaps can be properly applied. The preservation of the original blood supply while the flap is growing to its new source of supply is a cardinal point. It is often necessary to reenforce this normal blood supply by utilizing the principle of "delay." "Delay" in this instance means "a raising of the flap in stages, returning it to its original bed to await further circulatory reinforcement." Flaps which are fairly short, are of sufficient thickness and have an adequately broad base for nourishment "can be raised directly from this bed" and rotated 90 degrees in one operation. Other measures to safeguard a flap are to prevent tension, torsion, infection and lymphedema by proper location of the base or direction of the long axis of a pedicle flap. Therefore, "if one follows the embryonic segmental distribution of vessels, adequate venous and lymphatic return is assured, so preventing congestive hyperemia, with its resultant 'wet gangrene' of the flap."

Langer's lines should not be crossed at right angles by the margin of the flap "if one wants to prevent scar contracture at the margins."

The author further lists the types of flaps: (1) direct flap—(*a*) tubed, (*b*) open and (*c*) sliding—raised and applied to its recipient site in one operation, and (2) intermediate flap, in multiple stages with "waltzing." He feels that the tubed flap is of exceptional value in facial reconstruction, though he favors, in general, the use of the open flap, with a temporary covering of the under surface by means of a Thiersch graft.

In conclusion, Webster advises the use of a "large enough flap to allow for contracture" and careful planning of the "mechanical details of flap application."

According to Byers,[29] skin color consists of two factors: The first is pigment, and the second is the underlying vascularity. He feels, however, that the chief factor in the difference in color between grafts and their surrounding area is the absence of the red tone. To produce a better cosmetic result pigments have been injected permanently into the derma, with satisfaction and safety.

The method described employs a diversity of pigments to obtain a color to match the skin. These pigments are carried into the derma

28. Webster, G. V.: Choice of Pedicle Flaps for Plastic and Reconstruction Surgery, S. Clin. North America **24**:1472 (Dec.) 1944.

29. Byers, L. T.: Tattooing of Free Skin Grafts and Pedicle Flaps, Ann. Surg. **121**:644 (May) 1945.

by means of needles, which prick the pigment into the skin. A strict aseptic surgical technic being used and the process being painful where normal sensation is present, some form of anesthesia is advocated.

The procedure can be used to match skin grafts to the surrounding skin, to simulate missing vermilion of the lip, to blend in patchy scarred areas and to camouflage bald areas of the eyebrows.

Rubin [30] maintains that with the aid of 50 per cent gum acacia "glue" split skin grafting is simpler than with use of either the standard "pressure suture" technic or the Sano coagulum method. He stresses the fact that he obtained successful takes in 92 per cent of the grafts in two hundred and ten operations in unselected war wounds. Furthermore, 50 per cent gum acacia is readily available everywhere and is simple to prepare and sterilize. It permits easy application of grafts to difficult and irregular sites because of its adhesiveness. The operating time is reduced one half to one third of that in the suture method. Finally, the absence of a pressure dressing allows the patient to remain comfortable.

Jenney [31] describes his method of skin grafting, in which "cotton bobbinet" is applied to the drum surface of the Padgett dermatome by means of rubber cement, so that the removed skin adheres to the bobbinet, which prevents contracture. Graft and recipient areas are treated according to the plasma fixation technic of Sano, or prepared thrombin is used, "with equally good results." Pressure also is applied over the graft whenever possible. The author also devised a mirror attachment fixed to the Padgett dermatome, which permits the operator to observe the cutting of the skin graft on the drum surface.

(*Comment.*—The mirror attachment for the Padgett dermatome may be helpful. The cotton bobbinet idea is almost exactly like the method of film fixation described by Dr. Jerome Webster and associates in 1944.[32])

There is no doubt, according to Clark and associates,[33] that the application of thrombin to the raw surface of a graft and the recipient area is an advance in skin grafting. By this means complete and continuous contact of the skin and the underlying tissues is secured. Oozing of blood is also controlled, and the skin is fixed in position by means of a medium "favorable for tissue growth." The method is quick, since it largely obviates the need for stitching the graft in position.

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30. Rubin, L. R.: Simplification of Split Skin Grafting: Gum Acacia Technic, Am. J. Surg. **70**:302 (Dec.) 1945.

31. Jenney, J. A.: A Modification of the Plasma Fixation Method (Sano) of Skin Grafting by the Use of Bobbinet and a Mirror Attachment, Am. J. Surg. **67**:3 (Jan.) 1945.

32. Webster, J. P.: Film-cemented Skin Grafts, S. Clin. North America **24**: 251 (April) 1944.

33. Clark, A. M.; Todd, J. P., and Milne, G. R.: Fixation of Skin-Grafts with Human Plasma and Thrombin, Lancet **1**:498 (April 21) 1945.

(*Comment.*—In many articles by others, the authors point to the merits of substituting thrombin for pressure over a graft to control bleeding and to "cement" the graft to its bed. Most of these claims are simply a higher percentage of takes through use of the thrombin than when pressure alone is employed. My experience with thrombin in skin grafts does not substantiate the results reported in these articles, but a number of experienced and qualified plastic surgeons hold a contrary viewpoint.)

A case of successful skin grafting in a man with hemophilia is reported by Davidson and Levenson.[34] The bleeding from the donor site was controlled instantly by application of a mixture of sulfanilamide and thrombin to the area. Firm pressure dressings were applied to both donor and recipient sites. The donor site healed uneventfully in nine days, and the take of the skin graft was excellent.

According to Tanzer,[35] dental impression compound is a satisfactory and flexible medium for retaining a free graft within a cavity, but its desirable attributes persist only during the early stage of fixation of the graft. After the compound has been left in situ for a week or so, its porous character transforms the stent into a form of sponge, which retains secretions, becomes softened and develops an irritant quality, not conducive to rapid healing. The author makes two molds of the cavity in dental impression compound. On one of these stents a Thiersch graft is fixed with rubber cement and replaced in the socket, where it is retained for a period of one week. The second mold is sent to the dental laboratory, where a reproduction in acrylic resin is built and made available to the surgeon at the time that the graft is first dressed. The impression compound stent is then discarded and the acrylic resin form substituted. The latter is removed daily for cleansing.

A technic for preservation of human skin in the frozen state is described by Strumia and Hodge.[36] It consists in (1) preparing the skin with green soap, water and ether and (2) forming split skin grafts with a Padgett dermatome. The skin is (3) cut into uniform segments measuring 10 by 5 by 0.4 mm., which are (4) immediately immersed in citrated plasma contained in a rubber-stoppered bottle under aseptic conditions, (5) immediately placed at minus 20 to 25 C. and (6) maintained in a frozen state at this temperature until they are used. At this time (7) they are allowed to thaw by being placed in the bottle containing them, in a water bath at 37 C. (98.6 F.). The grafts are (8) then applied in the usual manner. By this method the authors

34. Davidson, C. S., and Levenson, S. M.: Skin Grafting in Hemophilia, J. A. M. A. **128**:656 (June 30) 1945.

35. Tanzer, R. C.: Use of Duplicate Stent in Cavity Grafting, J. Oral Surg. **3**:220 (July) 1945.

36. Strumia, M. M., and Hodge, C. C.: Frozen Human Skin Grafts, Ann. Surg. **121**:860 (June) 1945.

obtained 80.5 per cent permanent takes in forty-one autogenous grafts preserved from one to sixty-one days and transplanted in 3 patients, whereas thirty-four control grafts of fresh skin in the same patients resulted in 86.4 per cent of takes.

This method of preservation of skin is suggested as a means of allowing surgeons to obtain at one operation large numbers of grafts to be used for later transplantation.

Matthews [37] states that skin kept under refrigeration for as long as eight weeks may be used successfully for autogenous grafts. The storage of skin grafts saves the patient with a large denuded area from a succession of operations, reduces the number of donor areas required in multiple stage plastic repair of a healed wound, is particularly useful in the event of partial failure of an initial graft and permits application of the graft at the optimum time as a bedside dressing. Use of fibrin instead of sutures simplifies fixation without anesthesia.

Commander Webster [38] presents a simple inexpensive skin graft knife which utilizes 2¼ inch (5.7 cm.) removable razor blades obtainable in packages of five at any drug store. These blades fit into a slotted handle similar to a Ferris Smith knife. The author has developed this instrument to obviate the difficulties generally encountered, namely, lack of sharpness and clumsiness. He feels that this knife can be used easily by any inexperienced operator to cut split skin grafts by the free hand method.

A more detailed description is given by Marcks [39] for the use of his modified calibrated skin-grafting knife. Experience during the past few years has established that it removes skin grafts from various donor surfaces of the body in a satisfactory manner.

In the use of the drum technic of skin graftnig, as described by Padgett in his book on skin grafting, some surgeons have been using a backing on the drum, such as plio film (Webster) and cellophane (Evans). Green and his associates [40] suggest a fine gage nylon cloth for the same purpose. Before the graft is cut, the drum is coated with dermatome cement and the backing is cemented to the drum as smoothly as possible. New coats of cement are then applied to the backing and to the donor site, and the graft is cut as described by Padgett. The graft, with its back, is removed from the drum and placed on the recipient site. No sutures are needed to maintain the graft at its original

37. Matthews, D. N.: Storage of Skin for Autogenous Grafts, Lancet **1**:775 (June 23) 1945.

38. Webster, J. V.: A Simple Skin-Graft Knife for General Use, Am. J. Surg. **67**:569 (March) 1945.

39. Marcks, K.: Modified Calibrated Skin-Grafting Knife, Surgery **17**:109 (Jan.) 1945.

40. Green, R. W.; Levenson, S. M., and Lund, C. C.: Nylon Backing for Dermatome Grafts, New England J. Med. **233**:268 (Aug. 30) 1945.

size and tension, it being merely held in place by even elastic pressure provided by a suitable pressure dressing, with or without external splinting.

The advantages claimed by the authors for their nylon cloth backing are (1) that nylon can be sterilized as easily as any textile and is physically unchanged after sterilization and (2) that grafts backed with nylon conform better to irregular surfaces than do those backed with cellophane; yet, in spite of the relative limpness of the nylon before it is attached to the skin, it prevents contraction of the graft as well as cellophane or sutures.

### PLASTIC OPERATION ON THE NOSE

There are definite indications for employment of the usual nasal plastic operations even in the urgent days of wartime military practice, as pointed out by Webster.[41] The author expresses the opinion that nasal plastic operations should be restricted to correction of deformities acquired in military service. However, an exception to this rule should be made when a preexisting deformity constitutes a definite hazard to health and when gross disfigurement of the patient has resulted in an anxiety neurosis under the stress of war. Deep saddle deformities are repaired by autogenous rib cartilage grafts in preference to preserved cartilage grafts, which are used by many other plastic surgeons. The principal features felt to be in favor of the use of autogenous cartilage are solidity, resistance to infection, early fixation of the graft by connective tissue and, in young persons, growth. The disadvantages are additional risk, discomfort and the hospitalization necessary to obtain fresh autogenous cartilage at the time of operation. These disadvantages are not serious for young healthy adults.

It is the opinion of Griesman[42] that the final cosmetic result of a rhinoplasty depends not only on the surgical procedure but also on the healing factors of the patient's nasal tissues. The force of mastication is the main physiologic stress exerted on the facial skeleton in a vertical and longitudinal direction, and following a typical rhinoplasty the lateral osteotomy interrupts transmission of the force of mastication. For this reason, chewing hard on tough foods should be omitted for about six weeks following a rhinoplasty operation.

There is little doubt that many people are nose conscious, and most of them labor under the mistaken idea that a good nose is a panacea for every facial defect, as pointed out by Daley.[43] Often a person is

41. Webster, G. V.: The Proper Use of Nasal Plastic Operation in Military Practice, Arch. Otolaryng. **41**:170 (March) 1945.

42. Griesman, B. L.: Structure of the External Nose: A Study from the Point of View of Plastic Surgery, Arch. Otolaryng. **42**:117 (Aug.) 1945.

43. Daley, J.: Introduction of an Artistic Point of View in Regard to Rhinoplastic Diagnosis, Arch. Otolaryng. **42**:33 (July) 1945.

determined to have his nose remodeled, being unaware of the fact that the nose is good and that the chief fault lies elsewhere.

Perfect symmetry is not necessarily the aim in rhinoplasty, but a good nasal reconstruction not only should bring anatomic abnormalities within the normal range but should take into consideration the esthetic disproportions. These esthetic variations should also be brought within the range of a more ideal concept. Correction of a long nose with a normal upper lip will require good judgment on the part of the operator when he decides what amount of shortening is necessary to obtain the most pleasing effect. Protrusion or recession of the chin, the upper lip or the forehead must be taken into consideration and properly analyzed and compensated for.

According to Fox,[44] injuries to the nose are common, especially during childhood and adolescence, and, although all do not result in fracture, almost every instance of nasal deformity in young persons is due to unrecognized fracture. Reduction is a simple procedure at the time of injury, but if a fracture in a child is neglected for as long as three weeks a plastic operation will be necessary to restore the shape of the nose. With the patient under general anesthesia, preferably pentothal sodium administered intravenously, the nasal arch is lifted, so that the bones may be molded into normal position with the fingers. The septum is straightened and placed in midline with a Kyle forceps, unnecessary tearing of the mucous membrane being studiously avoided. The nares are then packed with dry iodoform or sulfonamide-impregnated gauze tape and an adhesive-covered felt-lined aluminum splint is applied to the nose.

(*Comment.*—Nasal fractures in infants and small children are difficult to diagnose and are often neglected. When the edema subsides, the family doctor may note the presence of nasal deformity and refer the case to an otolaryngologist, who diagnoses the fracture but as a rule informs the parents that nothing can be done to correct the distorted appearance of the nose until their child is 17 years old, since refracture of the bones or adjustment of the nasal septum would interfere with "the growth of the nose." This rule has no basis in fact. Refracture and proper alinement of a healed fracture of the nasal bridge, nasal septum or both will allow more normal development of a child's nose and will not inhibit growth of the nose.)

Lamont [45] holds that unreduced nasal fractures not only are cosmetically unattractive but also interfere with the function of the nose. Should the fracture occur early in life, growth of the structures may be

44. Fox, S. L.: The Fractured Nose, Eye, Ear, Nose & Throat Monthly **24**:286 (June) 1945.

45. Lamont, E. S.: Plastic Surgery of Nasal Fractures, Am. J. Surg. **69**:144 (Aug.) 1945.

impaired; this must be kept in mind when reconstructive procedures are contemplated. A severely traumatized nose should be considered fractured until proved otherwise.

Preserved cadaver cartilage (necrocartilage) has been used by the author intranasally in 75 cases, some of which were followed over a period of three years. Examination of the nose revealed no striking clinical change in these cartilaginous implants. Lamont reports the loss of the cartilage graft in 2 cases. In both, the graft was inserted at the columellar philtrum junction for repair of a depression.

In 130 cases of nasal fractures of all types reported by Hersh,[46] the patients were treated in the following way: External molded splints of dental compound were used for protective purposes only, and Simpson's splints and occasionally petrolatum gauze were placed inside the nose only to prevent dislodgment in the event of undue pressure during the sleeping or waking hours. The fractured and displaced segments of the bony vault were brought in proper position by external manipulation with the fingers, and traction was applied inside the nasal cavities by means of the Ash forceps or a periosteal elevator. In most instances the internal supports were removed within twenty-four hours, because the pronounced edema of the mucous membrane acted as an adequate splint internally after this time. Sulfanilamide powder was dusted in the lacerations, and in cases of severe fracture one of the sulfonamide derivatives was administered orally as a prophylactic measure.

Maliniac[47] advises early resetting of the septum following fracture-discolation. When a number of days have elapsed following injury, resistance may be encountered which will necessitate open resetting of the septum. The author states the belief that methods of repair described in the literature for the correction of old fracture dislocations of the septum provide satisfactory replacement for the lower border of the septal cartilage but rarely remedy the lateral displacement of the septum. This lateral displacement of the septum prevents realinement of the nose into a normal midline position following refracture of the bony bridge.

He recommends wide exposure of one side of the septal cartilage and excision of small segments of cartilage in a vertical direction or by crisscrossing incisions when the curvatures are less pronounced. In all these manipulations it is essential to preserve the mucous membrane on the opposite side. The resistance, which must still be eliminated in many instances before the entire dorsum can be straightened, is due to the short and thickened mucous membrane on the convex side. Here an anterior-posterior incision along the floor of the nose is required.

46. Hersh, J.: The Management of Fractures of the Nasal Bony Vault, Ann. Otol., Rhin. & Laryng. **54**:534 (Sept.) 1945.

47. Maliniac, J. W.: Fracture-Dislocations of the Cartilaginous Nose, Arch. Otolaryng. **42**:131 (Aug.) 1945.

The upper and lower lateral cartilages of the nose are freed and trimmed or crisscrossed to adapt their shape to the new position of the nose following refracture of the bony bridge.

(*Comment.*—The article presents a method of approach and repair for old fracture dislocations of the septum associated with external nasal deformity by an experienced observer. Editorial disagreement with some of the author's statements would be in the nature of hair splitting and serve to detract from an excellent clinical presentation, which should be read by all surgeons interested in this type of work.

This department emphasizes, however, that one cannot always completely correct a striking lateral displacement of the nose associated with an old fracture displacement of the nasal septum, regardless of the type of procedure used for the repair. It is safe to anticipate adequate space in the nasal chambers for respiration and for sinus drainage following operation, but complete correction of the external deformity is not always possible.)

In Maliniac's opinion,[48] an accurate fitting of a small graft on the nasal dorsum is often difficult, as its partial absorption or slightest displacement is liable to mar the end result. Utilization of the adjacent lateral cartilages for this purpose by widely separating them from the soft tissues and shifting them to meet or overlap in the region of the saddle depression (figs. 1 and 2) is more desirable. The latter method assures permanence of volume (absence of absorption) and good immobilization. The same procedure applies to the mobilization of the lower lateral cartilages (alar cartilages), which can easily be disconnected from the surrounding structures and affixed in a higher position, thus correcting certain malpositions of the nasal tip. In conjunction with the transposition of the lateral cartilages, there are frequently indications for elevation of the bony dorsum through infracture of the frontal process of the maxilla. These steps can be carried out separately or together, depending on the requirements of the individual case.

(*Comment.*—The view is held by my department that utlization of mobilized lateral and alar cartilages to fill shallow saddle depressions is a useful contribution.

It should be noted, however, that wide separation of these cartilages from the mucous membrane and overlying skin for mobilization renders them, in effect, free cartilage grafts and therefore exposes them to the same risk of partial absorption following operation, according to the older viewpoints on this subject.

More recent investigation has indicated that all forms of adult autogenous cartilage grafts tend to retain their original bulk after trans-

48. Maliniac, J. W.: A Procedure for Elevation of the Nasal Dorsum by Transposition of the Lateral Cartilages, Arch. Otolaryng. **41**:214 (March) 1945.

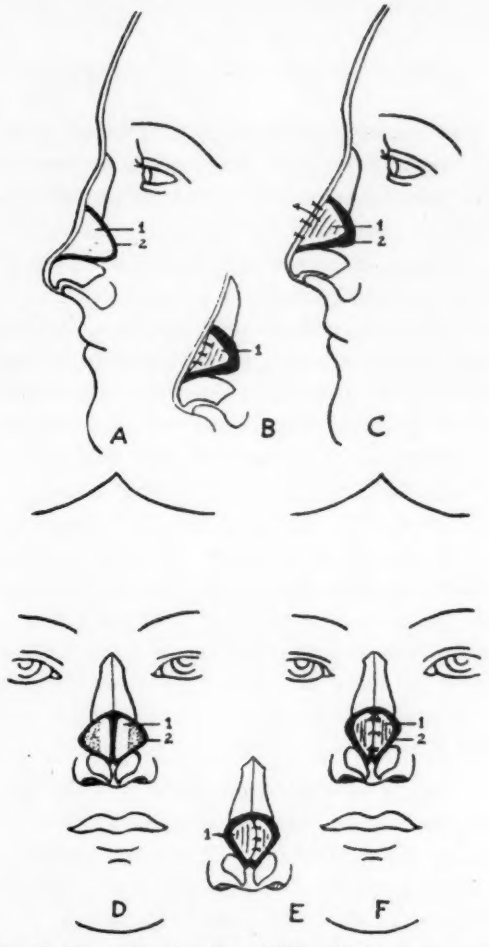


Fig. 1.—*A*, dorsal depression in the middle third of the nose, such as often occurs after external trauma. The upper lateral cartilages (*1*) in such instances are often apt to be thickened and deformed. *B* and *C*, the lateral cartilages are severed from the pyriform aperture (*2*) and from the underlying mucous membrane. The pliability is increased by multiple incisions if required. The cartilages are affixed in the depression by approximation or superposition. *D*, *E* and *F*, front views of *A*, *B* and *C*. (After Maliniac.)

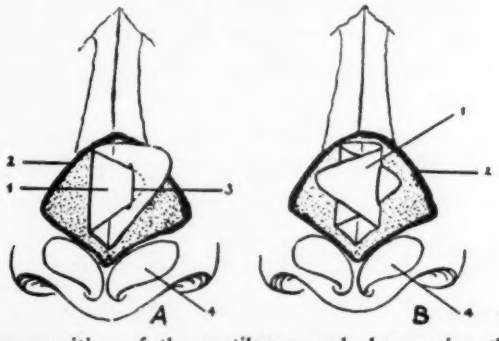


Fig. 2.—*A*, transposition of the cartilages made by passing the distal end of one cartilage (*1*) through a buttonhole (*3*) made in the other. *B*, the doubling up of the cartilages permits the filling out of defects of greater depth. The alar cartilages (*4*) can be handled in the same way as the upper lateral ones for the purpose of elevation of the nasal tip. (After Maliniac.)

plantation and that young cartilage grafts tend to grow. It does not therefore appear logical to assume that widely separated lateral or alar cartilages resist absorption more than lateral or alar cartilages transplanted completely as free grafts.)

Alloplastic materials, like all foreign bodies, are incapable of becoming incorporated as an integral part of the tissues, in the opinion of Fomon and colleagues.[49] Sooner or later they are likely to become absorbed, undergo infection or be extruded in the process of inflammation and ulceration. Implants of soft tissue such as dermal grafts and fascia have a tendency to undergo absorption, and cartilage grafts are apt to curl after transplantation. The authors state the belief that cancellous bone obtained from the ilium is an unrivaled grafting material for a saddle nose and other deformities of the nose requiring the use of a filling substance or structural support. The spongy character of cancellous bone renders it adaptable for the penetration of tissue fluids and tissue cells from the host, as a result of which there is a greater assurance of vascularization and a relatively short period of organization. In the observation of cases in which cancellous bone grafts had been transplanted in the nasal tissues, there was no clinical evidence of absorption of the grafts over a period of three years following transplantation.

(*Comment.*—As emphasized by the authors, both autogenous cartilage and autogenous bone can be used successfully to give structural support to the nose and to fill depressions. Each has certain advantages and disadvantages, and a choice between the two materials is largely a matter of preference by each individual operator.

For the otolaryngologist doing occasional nasal plastic operations, I recommend septal cartilage grafts reenforced with alar cartilage, the alar cartilage being placed over the septal cartilage to provide a smooth rounded contour for the nasal bridge.

When a surgeon decides that a bone graft is indicated (in cases in which septal cartilage is not available in sufficient quantity), why should he not use septal bone rather than iliac bone? Septal bone can be shaped easily, and the otolaryngologist is working in a familiar field in obtaining this graft.

Experimental work by members of this department has demonstrated that septal bone grafts transplanted without periosteum beneath the abdominal skin remained unaltered for periods up to five years after transplantation. Rib bone and tibial bone grafts transplanted under similar conditions completely disappeared one year after transplantation. No iliac bone grafts were used in these experiments.)

49. Fomon, S.; Luongo, R.; Schattner, A., and Turchik, F.: Cancellous Bone Transplants for the Correction of Saddle Nose, Ann. Otol., Rhin. & Laryng. **54:** 518 (Sept.) 1945.

According to Beck,[50] abscess of the nasal septum may result from infection anywhere in the neighboring tissues (as with ethmoiditis) but it occurs most frequently after accidental or surgical trauma. The pus may be found on one or both sides of the cartilaginous and bony septum. In 2 cases reported by the author, incision on one side only was adequate. If both sides of the septum are incised for drainage, the incisions should be made at different levels, to avoid perforation. The cartilage apparently disintegrates, but fragmentation or sequestration of cartilage or bone is not always recognized at the time of and following surgical drainage. Abscess of the septum following trauma is preceded by the formation of a hematoma between the mucoperichondrium and the cartilage. Abscess following sinusitis probably is not preceded by the formation of hematoma.

New [51] describes a "sickle skin flap" for the repair of moderately large defects of the nostrils and the tip of the nose (fig. 3), which has the advantage of causing less deformity than the usual Indian type of forehead flap. The flap is sickle shaped and generally about 3.5 to 4 cm. in width. Beginning just above the zygoma in front of the ear, it extends backward and upward with the parietal branch of the superficial temporal artery in the pedicle and then curves forward on the forehead to the bay of skin just below the hair line. The skin in this area, which is at the end of the flap, is used for the reconstruction and may be sufficient for half a nose, an ala or a tip. When the flap is detached from the nose and replaced on the forehead it may be possible to stretch the flap so as to cover the entire defect. This lowers the hair line a little but in most cases not enough to be noticeable. The remainder of the scar is in the patient's hair line and therefore will be concealed.

Seltzer [52] has noted that a waxy immobility of the tissues about the nose often occurs following a rhinoplasty in which the nasal skin has been separated from the periosteum. He presents a "modified operation," in which the skin is separated from the underlying structures only as far upward as the lower margin of the bony bridge. By means of a periosteal separator, the periosteum, with the overlying skin and muscles, is then separated from the bony bridge.

(*Comment.*—This procedure is commonly used by all well trained men doing nasal plastic operations.)

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50. Beck, A. L.: Abscess of the Nasal Septum Complicating Acute Ethmoiditis, Arch. Otolaryng. **42**:275 (Oct.) 1945.

51. New, G. B.: Sickle Flap for Nasal Reconstruction, Surg., Gynec. & Obst. **80**:497 (May) 1945.

52. Seltzer, A. P.: Fixity of Facial Expression Following Undermining of the Skin over the Nose, Am. J. Surg. **68**:326 (June) 1945.

Mootnick [53] suggests that during the process of sawing off the nasal hump the bayonet saw should be placed below the glabella, a few millimeters more or less, as the case indicates, and the sawing of the nasal hump should be continued until it is severed. The upper end of the nasal bony hump will be found still attached to the frontal sagittal suture, and by means of a 10 mm. chisel placed on the flat surface underneath

Fig. 3.—*A*, postoperative defect of the left ala and tip of the nose one year after removal of a postirradiated epithelioma with surgical diathermy. The sickle flap has been elevated, and the forehead end has been lined with a skin graft. *B*, the lined flap has been brought down to the nose. The flap has been tubed by means of a petrolatum fine mesh bandage. A skin graft has covered the defect in the scalp and forehead. *C*, the flap has been replaced. Note the reconstructed part of the nose and the small area of skin graft on the forehead, which can readily be covered with the hair. Photograph made two weeks after the last stage of the operation. *D*, defect following removal of the postirradiated squamous cell epithelioma of the nose. This was replaced with a lined sickle flap from the scalp and the forehead. *E*, it was possible to stretch the replaced flap so that the small area of the skin graft that was left was excised three months later, without leaving any grafted area on the forehead. The skin of the reconstructed portion of the nose matches in color and texture that of the rest of the nose. (After New.)

53. Mootnick, M. W.: Lowering the Glabella in Rhinoplasty, Laryngoscope **55**:28 (Jan.) 1945.

the hump the severance of the bony hump is continued until the frontonasal articulation is met. The chiseling is then continued on either side of the upper end of the nasal bone, with a 7 mm. chisel placed at an angle, directed inward, upward and backward, until the frontonasal articulation is reached. By manipulation of the nasal bony hump slightly upward from side to side, it may be dislodged and freed from its attachment to the frontal bone. The nasal hump when removed will include part of the glabella.

A device for cutting cartilage isograft is described by Stagman,[54] which in his hands has proved useful. The instrument, which was designed on the general principle of the common paper cutter, will cut down a block of cartilage to the right size quickly. Fine finishing can then be accomplished by hand.

Tamerin[55] describes a new instrument devised for the purpose of removing the bony debris from the Joseph saw employed in corrective rhinoplasty. This instrument is a three-sided file that is triangular shaped to fit into the interstices of the saw teeth. There is evidence that the transfer of bony debris from one patient to another may be attended by a postoperative foreign body reaction that is almost indistinguishable from an infection. The author has noted a distinct drop in the number of postoperative complications in his cases by cleaning the saws between operations.

### PLASTIC OPERATIONS ON THE FACE

Morani[56] points out that Edward Zeis first used the term plastic surgery in 1838 but that this field of surgery was known in 2250 B. C., as noted on the Code of Hammurabi, of Babylon. She gives an interesting though brief history of its development by the Hindoos of about 750 B. C., who were capable of skilful skin shifting, reconstructing a lost nose or lip by advancing a cheek flap, through Celsus, who about the year 30 A. D. wrote "De Re Medica," a book in which "may be found minute description of the technic to be employed in plastic operations." Galen (131-201 A. D.) described repair of harelip as well as that of the ears and the ala of the nose.

In her second article, Morani[57] continues her brief review of the history of plastic surgery. She points out that surgery in Europe

54. Stagman, J.: A Device for Cutting of Cartilage Isografts, Arch. Otolaryng. **42**:284 (Oct.) 1945.

55. Tamerin, J. A.: A New Instrument for Cleaning Rhinoplastic Saws, Arch. Otolaryng. **41**:303 (April) 1945.

56. Morani, A. D.: Evolution of Plastic Surgery: Part I., M. Woman's J. **52**:32, 33 and 40 (April) 1945.

57. Morani, A. D.: Evolution of Plastic Surgery: Part II, M. Woman's J. **52**:25-28 and 43 (Oct.) 1945.

received its impetus during the Crusades, when the barbaric crusaders acquired the knowledge and skill of the Moslems. Roger Frugari (1170 A. D.) is considered one of the founders of modern plastic surgery, for he was the first to suggest repair of torn intestine by suturing. Antonius Branca is credited with devising the arm flap operation for reconstructing the nose—the so-called Italian method of rhinoplasty.

The first systematic treatise on plastic surgery was written by Casper Tagliacozzi in 1597, in which he described various operations on the lip and the ear and the pedicle flap from the arm to the nose. He also practiced scar revision. In 1818 von Graefe published a monograph "Rhinoplastic." In 1804 Baronio successfully grafted the skin of a sheep from one side of the body to the other. The lined flap for use in rhinoplasty was developed by Dieffenbach (1797-1847). The first repair of a cleft palate was performed by Mettauer, in Virginia, in 1827. The first nasal reconstruction in this country was done by Warren in 1834, a forehead flap being used. He also employed free full thickness skin to repair the eyelid and nose. Reverdin, in 1869, described his "epidermic graft" (which contained corium). Skin grafting was practiced by Thiersch in 1886, who used a thin film of dermis. Krause, in 1893, advised the use of the full thickness graft in all cases in which the Ollier-Thiersch graft did not give the proper restoration. Dunham, of New York, in 1893, first reported successful use of the artery with accompanying veins and nerves in the pedicle for a flap.

Becker [58] describes an operation for the correction of protruding ears which combines the procedures introduced by Davis and Kitlowski, and those of New and Erich. A minimum amount of cartilage is removed at the conchal scaphoid junction, and the cut edges of the cartilage are held firmly in position by surgical clips instead of mattress sutures tied externally over cotton rolls. Small pieces of sterile rubber sponge are placed in the convolutions of the ear on the anterior surface and sterile gauze pads are laid over this and behind the ear. Finally, a tight mastoid bandage is applied.

(*Comment.*—One might suppose that the application of a tight bandage over metal clips would cause pressure necrosis of the skin in some cases. The advantage of metal clips instead of sutures is therefore not evident.

Complete removal of even a small segment of cartilage at the concha scaphoid junction and apposition of the edges of the cartilage not infrequently produce an unsightly ridge at this point, which gives an abnormal appearance to the anterior surface of the auricle. There is a growing tendency among plastic surgeons to make parallel incisions

58. Becker, O. J.: Surgical Correction of Protruding Ears, Eye, Ear, Nose & Throat Monthly **24**:177 (April) 1945.

through (or partly through) the cartilage instead of removing a complete segment of cartilage. The latter procedure does not tend to cause any abnormal ridges on the anterior surface of the auricle.)

Since injured ears produce such conspicuous deformities, every effort, in Webster's [59] opinion, should be made to preserve all viable or questionably viable tissues. Later reconstruction, though painstaking, never duplicates the normal ear. He advocates early aseptic evacuation of hematomas through a tiny incision in the anthelix fold to prevent cauliflower ear. Lacerations should be repaired primarily if no appreciable loss of tissue has occurred. A burned scar should be kept from drying, and granulating surfaces should be grafted as soon as possible.

Straatsma [60] expresses his view that plastic surgeons should correct the prevalent fallacious beliefs regarding the miracles accomplished by reconstructive surgery. He emphasizes that the appearance of servicemen with extensive facial injuries can be greatly improved. It is not possible, however, to erase all evidence of injury. The familiar story of the marine or bomber pilot who had most of his face shot away but was made "as good as new" by plastic surgery belongs in the realm of pure fiction. The treatment of scars is still one of the major problems of the reconstructive surgeon. Much additional research must be carried on because in known cases all methods have failed to halt progression of the hypertrophied scar and keloid.

Nowhere in the body is one required to be so meticulous in the care of traumatic wounds as with those which occur about the face and neck, in the opinion of Curtis.[61] Few deformities have the same detrimental effect on the mind and emotional stability as do poor results in the treatment of these areas. Relative to the treatment of patients in acute war casualties, Curtis quotes Col. James B. Brown as follows:

> The rules are very simple. They are just a matter of keeping things clean, not doing any more harm than has already happened to the patient, realizing what *has happened* and replacing tissues as close as possible to their normal positions for function and appearance. Complicated repairs and restorations necessarily have to be allotted sufficient study and time for repair and recovery.

Despite thorough early treatment, gunshot wounds of the face frequently result in extensive facial deformities, which may involve all the facial structures. Lewin [62] states that the rehabilitation of persons with these injuries may require correction of external facial deformities,

59. Webster, G. V.: Care of the Injured External Ear, Surgery **18**:515 (Oct.) 1945.

60. Straatsma, C. R.: Plastic and Reconstructive Surgery, Mil. Surgeon **96**: 255 (March) 1945.

61. Curtis, L.: Face Injuries, Clinics **3**:1430 (April) 1945.

62. Lewin, M.: Reconstructive Treatment of Gunshot Wound of the Face and Neck, Arch. Otolaryng. **42**:191 (Sept.) 1945.

replacement of mucous membrane and treatment of compound comminuted fractures of the facial skeleton. In the correction of external facial deformities, the best cosmetic result can be obtained by utilizing the available skin of the face and neck. Epithelial inlays are often resorted to in replacing the missing mucous membrane with skin grafts. In the treatment of compound and comminuted fractures of the mandible, fixation in a functional position is of primary importance. Persistent drainage is due to the presence of sequestrums and will cease when they are removed. Preserved cartilage is satisfactory material for correction of contour defects of the face.

A rare case of ossification of the masseter muscle following an injury to the right side of the face is reported by Cameron and Stetzer.[63] During the ensuing two months the right side of the face gradually increased in size, and it became more and more difficult to open the jaws. Roentgenographic examination showed considerable calcification in the masseter muscle on the right side. With the patient under anesthesia induced with solution of tribromoethanol, an incision was made above the angle of the mandible. No abnormal tissues were seen until the masseter muscle was exposed and a bony mass, 2.5 cm. in size, removed from the muscle substance. The patient was able to open his jaws after operation, but one month later the jaws began to stiffen again and the cheek was hard to palpation. A second operation was performed six months later, when the masseter muscle was found to be completely calcified from its origin on the zygoma to its insertion on the mandible. The mandibular and zygomatic attachments were severed by means of a mallet and chisel and the entire muscle removed en masse. The patient was discharged on the sixth postoperative day, at which time he was able to eat and talk normally. Nine months after the second operation he was again operated on for removal of additional calcification in the same area.

Wachsberger [64] describes a modified traction and fixation splint for fractures of the facial bones which meets the following requirements: (1) The splint is fixed firmly yet comfortably to the uninjured parts of the skull; (2) it is light in weight; (3) multiple attachments are provided, and each attachment is movable to any desired position around and distant from the face, and (4) the amount of traction is adjustable to a fine degree without undue discomfort to the patient.

Ungley and Suggit [65] have found that the temporal approach for the reduction of fractures of the zygomaticomaxillary arch is not always

63. Cameron, J. R., and Stetzer, J. J.: Myositis Ossificans of the Right Masseter Muscle: Report of a Case, J. Oral Surg. **3**:170 (April) 1945.

64. Wachsberger, A.: Modified Traction and Fixation Splint for Fractures of Facial Bones, Arch. Otolaryng. **42**:53 (July) 1945.

*(Footnotes continued on next page)*

satisfactory. This is because the fragments sometimes do not remain in position after the elevating force is removed. By means of the canine fossa approach, the fractured bones can be clearly seen and often manipulated or wired in the correct position. In some cases it may be necessary to insert a wire loop under the depressed fragment of bone and attach the ends of the wire to a rigid bar incorporated in a plastic hood cap. Late restoration of the orbital floor rarely overcomes the diplopia, and in such cases, if the symptom is severe, it may be necessary to suppress the eye.

According to Nesbitt and Leeds,[66] in fractures of the zygoma the bone is usually driven into the maxillary antrum and impacted there. The violence that causes the fracture may be slight and the condition entirely overlooked. The authors prefer to treat fracture of the zygoma by the Caldwell-Luc approach to the antrum through an incision in the gingival sulcus. All loose fragments and any residual blood clot are removed, and the impacted bone is raised upward and outward to reconstruct the inferior orbital margin. The antrum is then packed with gauze, the end of the gauze being brought out through an opening in the inferior meatus.

Mowlem [67] reports the use of cancellous chip grafting for the restoration of contour and of continuity in fractures of the facial and cranial bones, the mandible and the tibia. The graft is always removed from the ilium because of its relatively higher cellular content and for the porosity. The correct contour is obtained by simply building up the bone chips to the requisite levels. Fixation with a pressure bandage for from four to six days completes the procedure. This bone chip method for restoration of contour simplifies the operative technic, in that wide exposures, beveling of cranial margins, tedious shaping of one piece grafts and difficult fixations have been eliminated. In their place is a restricted wound of access, and contour is regained by merely adding or subtracting the requisite number of bone chips.

A new and simplified technic for bone grafting to restore contour of a defect is presented by Barsky.[68] It consists of utilization of many minute pieces of cancellous bone covered with thin shavings of cortical bone pressed into shape and immobilized by a mold prepared before the operation. The advantages of this substance over diced cartilage and derma grafts are enumerated, but the author admits that this material should be used only in selected cases.

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65. Ungley, G. H., and Suggit, S. C.: Fractures of the Zygomatic Tripod, Brit. J. Surg. **32**:287 (Oct.) 1944.

66. Nesbitt, R. E., and Leeds, C. R. D.: Fractures of the Zygoma Bone, Brit. M. J. **1**:512 (April 14) 1945.

67. Mowlem, R.: Cancellous Chip Bone Grafts, Lancet **2**:746 (Dec. 9) 1944.

68. Barsky, A. J.: The Molded Bone Graft, Surgery **18**:755 (Dec.) 1945.

Tickle [69] discusses the surgical repair of the facial nerve following injury. He concludes that direct repair, a piece of fresh nerve taken from some sensory nerve in the body being used to bridge the gap in the facial nerve, is the method of preference. The facial nerve is exposed by biting off the tip of the mastoid with a pair of small rongeurs until the nerve may be seen entering the stylomastoid foramen. From here, by means of small curets and rongeurs, the nerve is uncovered up to the site of injury. If a piece of nerve is missing, the proximal end is then located and uncovered for a short distance until healthy nerve is encountered. The dehiscence in the facial nerve is then measured, and an autogenous sensory nerve graft is snugly placed between the cut ends of the facial nerve. Sutures are necessary only when the graft is in the soft tissues. Tickle does not favor the use of any of the "plasma glues."

Furstenberg [70] discusses the possibility of complete resection of the parotid gland without destruction of the facial nerve and the possibilities and advantages of an end to end anastomosis of the facial nerve when it is injured in the mastoid portion. The loss of as much as 1.5 cm. of nerve in the mastoid portion may be compensated for by complete removal of the nerve from the fallopian canal and freeing it down into the parotid gland. More extensive loss requires a transplant. Successful technic embraces the suturing of the nerve sheath only, avoidance of torsion and angulation and absence of infection.

Puntenney [71] states that plastic repair about the eyes involves reconstruction based on an attempt to restore the normal anatomy and physiology. His article deals with a brief review of the anatomy of the region and an enumeration of the common lesions encountered, together with methods most acceptable in repair. In this he quotes extensively from John Wheeler, Wendell Hughes and others.

Three cases are reported by Schaltz and Jaeckle [72] to illustrate the cosmetic and functional improvement about the eyes that can be obtained by various types of free grafts. The use of free mucous membrane grafts for the correction of severe symblepharon is described, as well as the free epithelial grafts to line an enucleated orbit in order to aid in retention of an artificial eye and a free full thickness skin graft to correct a cicatricial contracture of an upper lid.

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69. Tickle, T. G.: Surgery of the Facial Nerve in 300 Operated Cases, Laryngoscope **55**:191 (May) 1945.

70. Furstenberg, A. C.: Reconstruction of the Facial Nerve, Arch. Otolaryng. **41**:42 (Jan.) 1945.

71. Puntenney, I.: Plastic Procedures About the Eyes, Illinois M. J. **88**:238 (Nov.) 1945.

72. Schaltz, A., and Jaeckle, C. E.: Plastic Surgical Repair About the Eyes with Free Grafts, Arch. Ophth. **34**:103 (Aug.) 1945.

The authors feel that plastic procedures about the eyes should be performed by the properly trained ophthalmic surgeon because of his "special knowledge of the physiology and anatomy of the eye and its adnexa."

Resection of the levator muscle for the correction of ptosis is discussed by Berke.[73] He states that this procedure is the operation of choice when the levator muscle is not completely paralyzed. Disadvantages are that (1) this procedure can be used only when the levator muscle is present and active, (2) undercorrection may result and (3) lagophthalmos may occur if too much tissue is resected. From his experimental work, the author concludes that in resection of the levator muscle through the conjunctiva Muller's muscle and the tendon of the levator muscle are always excised together.

In an article by Hughes,[74] emphasis is placed on the use of tissues of normal lids to replace missing structures of the lids. If this is impossible, then tissues of the proper texture, color, thickness and flexibility should be employed. He stresses the importance of not using epidermis to line an upper lid when it may cause corneal damage. In enumerating substitutes for tissues of normal lids, he suggests either split skin graft, full thickness skin from the cephaloauricular angle or nearby skin as a pedicle. Use of mucous membrane from the mouth is recommended to replace conjunctiva. When the cornea is of no value, split skin grafts can be used. Cartilage from the ear or rib can be substituted for the tarsus.

In the opinion of Hughes,[75] the reconstruction of a good upper lid is a difficult surgical problem, for it must provide: (1) a minimum protection for the conjunctiva and cornea, (2) motility sufficient to spread tears over the eye by winking and (3) cutaneous tissue matching the opposite side in color and texture. He feels that skin should never be used to line the lid when a normal cornea is present. In such cases it is advisable to duplicate as nearly as possible a tissue that produces a lubricating fluid. For this purpose buccal mucosa is best. Since the lid needs rigidity and shape normally provided by the tarsus, either a section of tarsus from another lid or a piece of cartilage from the ear is recommended. A free graft of skin to provide eyelashes on the outer layer of the new lid can be reconstructed by utilizing a properly chosen strip of hair-bearing skin from the nasal end of the brow on the same side. A case is reported with drawings demonstrating each step in

73. Berke, R. N.: Resection of the Levator Palpebrae Muscle for Ptosis, with Anatomic Considerations, Arch. Ophth. **33**:269 (April) 1945.

74. Hughes, W. L.: Reconstruction of the Lids, Am. J. Ophth. **28**:1203 (Nov.) 1945.

75. Hughes, W. L.: Total Reconstruction of the Upper Lid (Blepharopoiesis), Am. J. Ophth. **28**:980 (Sept.) 1945.

the reconstruction of an upper lid. These steps are (1) blepharorrhaphy (to provide a protection for the eye), (2) free full thickness skin graft from the opposite upper lid, (3) free transplantation of the tarsus with conjunctiva attached, (4) reattachment of the levator muscle for motility, (5) transplantation of lashes and (6) incision to make the interpalpebral fissure. However, the method described is applicable only in cases in which there is a normal lower lid and a normal upper lid on the opposite side.

Hague [76] describes his application of the Wendell Hughes method of reconstruction of the upper eyelid to that of the lower eyelid. In this, he utilized the structure of the upper lid to form a lower one. Two cases of reconstruction of the upper lid by the Hughes method are reported, the first case being one of a basal cell carcinoma and the second traumatic loss of the right upper lid.

### DEFECTS OF THE SCALP AND SKULL

An excellent collective review of cranioplasty is presented by Woolf and Walker [77] as follows:

Indications for cranioplasty are (1) pain or tenderness about the skull defect; (2) headache and dizziness, aggravated by bending or stooping; (3) convulsive states; (4) cosmetic indications when depression or unsightly scars are in an exposed frontal region; (5) military reasons, because Army regulations state that a soldier cannot be returned to active duty if he has a cranial defect larger than 2 cm.; (6) feeling of insecurity on the part of the patient, and (7) psychogenic disturbances induced by the cranial defect.

Contraindications for cranioplasty are the following factors: (1) infections in the wound (the wound should be completely healed and free from infection for many months before a cranioplasty is performed; the use of sulfonamide drugs and penicillin may shorten this period); (2) abnormalities in the cerebrospinal fluid (alteration in the cellular constituents, proteins or pressure of the fluid usually indicates the presence of an active pathologic condition in the nervous system); (3) foreign bodies within the brain (fragments of bone are more apt to increase the incidence of abscess or epileptic manifestations than bullets and metal missiles), and (4) severe neurologic disability.

There are a number of types of cranioplasty. The material used for the repair of cranial defects may be derived from the same person (autogenous graft), from another of the same species (isogenous graft),

76. Hague, E. B.: Surgical Reconstruction of the Upper Lids, Am. J. Ophth. **28**:886 (Aug.) 1945.

77. Woolf, J. I., and Walker, A. E.: Cranioplasty: Collective Review, Internat. Abstr. Surg. **81**:1, 1945; in Surg., Gynec. & Obst., July 1945.

from another species (heterogenous graft) or from outside of the animal kingdom (metal or plant; alloplastic graft).

(*Comment.*—There is no doubt that the alloplastic grafts can be molded to a more complex contour to produce a cosmetic result superior to that obtained by other types of graft. Such shaping of the graft is especially necessary in the frontal region, where alloplastic grafts are particularly

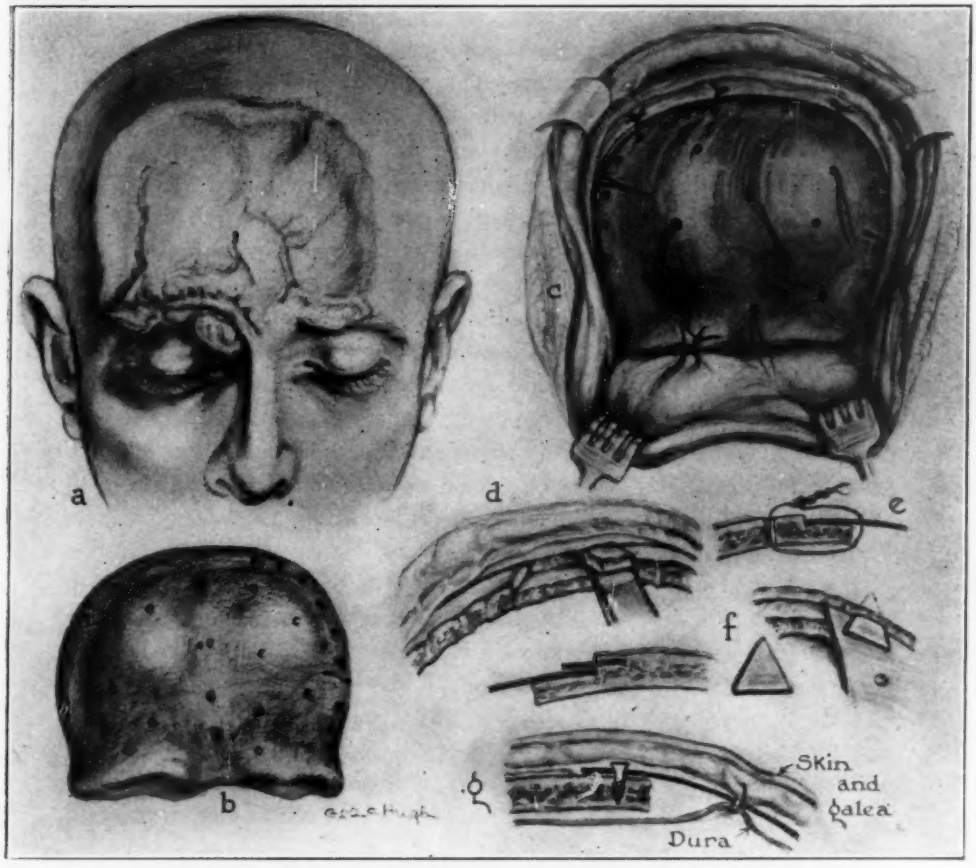



Fig. 4.—Sketches showing the technic of tantalum cranioplasty. The preformed plate (*b*) is immobilized in the defect (*c*) by such methods as shelving the outer table (*d*) with or without suturing to the margins of the skull (*c*) and (*e*), inserting triangular pegs of tantalum (*f*) or fastening the plate to the skull by tantalum screws (*g*). The method of eliminating the dead space beneath the plate by sutures from the dura mater to the scalp is shown (*c*) and (*g*). (After Woolf and Walker.)

desirable for defects. The introduction of a foreign body, even if inert initially, may be responsible for the late development of carcinogenic, epileptogenic or other sequelae. The lack of an immediate

tissue reaction, especially in experimental animals, is no guarantee that a late reaction may not occur.)

Mayfield and Levitch [78] prepare the tantalum plate in advance of the operation for the repair of a cranial defect. A plaster of paris impression of the skull deformity is taken, and from it a mold of dental stone is formed. The sheet of tantalum is placed over the mold and shaped by means of a screw jack press. The defect is then exposed at operation, and the prepared plate, which bears many perforations, is fitted over the defect. A shallow groove in the outer table of the skull is made to receive the plate edge. The authors conclude that tantalum more nearly fulfils the requirements of the ideal material for cranial repair than any other material now in use.

Openings in the skull remaining after craniotomy may be closed by overlaid or inlaid plates of tantalum, as described by Echols and Colclough.[79] The method was successful for 6 patients but not for 2, in whom the bone was infected before operation.

A tantalum plate may be placed on the skull so that the edges extend beyond the defect or cut to the shape of the defect and inlaid. For the overlay technic a plate 0.0125 inch in thickness is cut to size and shape with tinsmith's shears and hammered to correct curvature with a ball peen hammer. Multiple drill holes facilitate suturing or wiring and provide for drainage. The periosteum is separated from the edge of the defect, and the metal plate is placed directly on the bone.

Several new methods of cranioplasty which have appeared in the past few years include the use of plastics, vitallium and tantalum. Of these, tantalum has become the most popular, because of its inertness and the ease with which it can be handled. Woodhall and Spurling [80] performed tantalum cranioplasties on 79 patients at the Walter Reed General Hospital and, on the basis of this large series of cases, conclude that the method is satisfactory. The operation was usually carried out with the patient under local anesthesia after premedication with pentobarbital sodium, morphine and atropine. Indicated cortical resections and dural repairs were carried out, and then a ledge was formed in the bone edge. The plate was trimmed with heavy scissors to fit into the ledge, and fixation was secured with triangular points of tantalum. Penicillin was used parenterally and locally. No postoperative infections were encountered after the institution of this regimen.

78. Mayfield, F. H., and Levitch, L. A.: Repair of Cranial Defects with Tantalum, Am. J. Surg. **67**:319 (Feb.) 1945.

79. Echols, D. H., and Colclough, J. A.: Cranioplasty with Tantalum Plate, Surgery **17**:304 (Feb.) 1945.

80. Woodhall, B., and Spurling, R. G.: Tantalum Cranioplasty for War Wounds of the Skull, Ann. Surg. **121**:649 (May) 1945.

Harris and Woodhall[81] report the repair of a cranial defect with tantalum and conclude:

> Large cutaneous cerebral scars subsequent to extensive war wounds of the head present a problem in plastic revision that has not been solved . . . [In the case reported], through an error in operative technique, a tantalum plate was exposed after gangrene of an overlying, thin, atrophic scalp scar. Invasive infection of the brain was prevented by the use of penicillin while a pedicle graft was prepared and sutured in the resulting scalp defect. Healing of the pedicle graft sutured over the tantalum plate proceeded normally, and satisfactory cosmetic result was obtained.

Gardner[82] favors the use of tantalum for immediate or late replacement of osseous defects in the skull. He concludes:

1. The importance of the repair of defects of the skull has not been sufficiently stressed in the past.
2. A sheet of tantalum constitutes an almost ideal material for the repair of cranial defects.
3. It should be more widely employed for the immediate repair of compound fractures of the skull.
4. Small tantalum screws constitute the most satisfactory means of fastening the tantalum implant to the outer table of the skull.

Craniocerebral injuries present themselves, at times, as both a neurosurgical and a plastic problem, the solution of which should be accomplished at the initial operation. Balkin and Dowman[83] emphasize the difficulty of closing wide defects in the scalp by direct approximation of the tissues and advise the use of sliding flaps obtained from the borders of the defect. Generally one single pedicle flap of sufficient size can be obtained to cover the defect adequately, but occasionally it may be necessary to rotate two single pedicle flaps when availability of scalp tissue is limited. The donor site from which the pedicle flap has been removed may be covered with a split graft carefully sutured in position.

### PLASTIC OPERATIONS ON THE LIPS, JAWS, PALATE AND PHARYNX

According to Ruddy,[84] operations for the relief of congenital choanal atresia have been increasingly successful in adults and older children, but they have been less successful in infants and small children. In an attempt to improve the results in these young patients, the author successfully used a transpalatine approach instead of the usual approach through the nasal fossa. The technic was as follows: An incision was

81. Harris, M. H., and Woodhall, B.: Plastic Closure of Skull Defect (Case Report), Surgery **17**:422 (March) 1945.

82. Gardner, W. J.: Closure of Defects of the Skull with Tantalum, Surg., Gynec. & Obst. **80**:303 (March) 1945.

83. Balkin, S. G., and Dowman, C. E.: The Management of Extensive Scalp Defects in Cranio-Cerebral Injuries, J. A. M. A. **128**:70 (May 12) 1945.

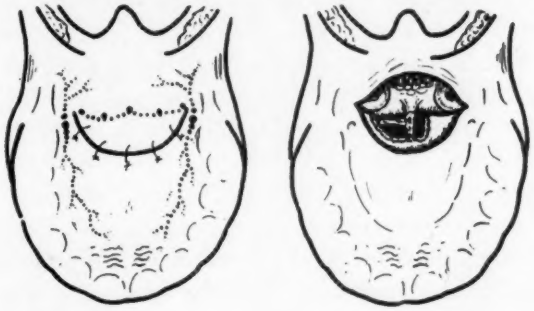
84. Ruddy, L. W.: A Transpalatine Operation for Congenital Atresia of the Choanae in the Small Child or Infant, Arch. Otolaryng. **41**:432 (June) 1945.

made through the soft tissues of the hard palate a short distance from the posterior edge of the bone. The soft tissues were then freed from the margin of the hard palate, exposing the atresia, which was removed with part of the posterior free margin of the nasal septum. The palatal mucous membrane was sutured back in position, and a small rubber

Fig. 5.—*A*, the patient, a girl aged 3 years. The nostril and the nasal floor on the left side are higher. The palate is shown as it appeared on the tenth postoperative day, just prior to removal of the sutures. *B*, lateral roentgenogram of the head ten minutes after iodized poppyseed oil 40 per cent had been instilled in the left nostril, with the patient in the dorsal recumbent position. The radiopaque oil lies against the choanal plate; none enters the nasopharynx. (After Ruddy.)

balloon attached to a no. 10 French rubber catheter was inserted to apply moderate pressure to the area operated on in the posterior nares for control of bleeding.

A case of bilateral congenital atresia of the choanae in an adult, which was repaired by the intraoral route, is presented by Klaff.[85] The procedure was as follows: With the patient under local anesthesia, an incision was made through the soft palate and retraction was obtained by inserting heavy silk sutures through each half of the separated soft palate, thus exposing the posterior surface of the bilateral occlusion. Openings were made in the bony occlusion with an antrum rasp and enlarged by rasping in a forward, medial and lateral direction, care being taken to avoid trauma posteriorly, which might cause injury to the sphenopalatine artery. A large rubber catheter was inserted through and through the openings and allowed to remain in place for ten days prior to removal. The soft palate was then sutured together and approximated in the midline. The openings were patent one year later, at which time the patient was readmitted for removal of the osseous bridge. This was accomplished with the patient under local anesthesia



A B

Fig. 6.—*A*, the position of the palatine vessels and the nerves to be avoided is indicated. The posterior margin of the hard palate has been roughly outlined by a few puncture marks made with a needle dipped in aqueous methylene blue. The incision and the approximate position of the sutures are shown. In *B* the posterior portion of the hard palate and the septum have been removed, as well as the entire atretic wall. Bilateral obstruction can be easily removed through the incision for removal of a unilateral obstruction. (After Ruddy.)

and probably should have been performed during the initial procedure, as it creates a single wide posterior chamber. This patient had normal hearing and also showed no abnormalities of the sinus.

Boyd [86] reviews the embryologic causation of choanal atresia and presents a case of bilateral bony choanal atresia in an adult. He eliminated the obstruction by first performing a submucous resection and then removing the obstructing bony atresia with biting forceps and chisel. One month following the operation, the edema had sub-

85. Klaff, D. D.: Bilateral Congenital Atresia of the Choanae, Arch. Otolaryng. **41**:298 (April) 1945.

86. Boyd, H. M. E.: Congenital Atresia of the Posterior Nares, Arch. Otolaryng. **41**:261 (April) 1945.

sided completely and the patient was able to breathe freely through his nose. At the end of three months the opening was patent and of about the same dimensions as at operation. The sense of smell developed slowly, and the secretions present in the nasal cavities before operation completely disappeared. The sinuses were normally developed, and there was no history of previous sinusitis. There was no history of aural trouble past or present, and a hearing test showed the patient to have excellent hearing. Boyd emphasizes the difficulty of evaluating different operative technics because, during his lifetime, one surgeon sees few, if any, patients with choanal atresia on whom he might try the different operative procedures.

As pointed out by Webster,[87] in planning the repair of disfiguring wounds about the lips and cheek, due regard must be given to blood and nerve supply and prevention of excessive scarring. He feels that the use of tissue from the immediate vicinity when possible is always the method of choice, for the local tissue in color and texture most nearly simulates that which was lost. However, although this is readily possible in repairs of cancer defects, since there one is dealing with older age groups and so with "tissue which yields readily to extensive shifting and stretching," this is not so in the youth of military age.

Webster then goes on to enumerate the time-honored rules of good treatment, listing the well known concepts of conservative débridement and suture of mucous membrane to the skin where perforating lesions through the mouth have occurred. A series of illustrations and reports of cases show the use of the principles enumerated. The author concludes that late repairs should be confined to replacement by local tissue or by matching tissues only.

In the opinion of Brown and McDowell,[88] simplification of the design for incisions in the repair of cleft lips is an important consideration. This is true because less time is consumed and more attention can be devoted to shifting and suturing the tissues in proper position. The authors describe the simple V excision, the flap operation and a simplified design which provides a flap for the nostril floor and does not produce undue tightness at the free border of the lip. A normal curl for the flattened nostril is provided by undermining between the lining and skin of the nostril so that they will slide on each other when the nostril is rolled inward. At times it is necessary to make a vertical cut just in front of the inferior turbinate to allow complete rotation of the nostril.

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87. Webster, G. V.: War Wounds of the Lips and Cheek, U. S. Nav. M. Bull. **45**:819 (Nov.) 1945.

88. Brown, J. B., and McDowell, F.: Simplified Design for Repair of Single Cleft Lips, Surg., Gynec. & Obst. **80**:12 (Jan.) 1945.

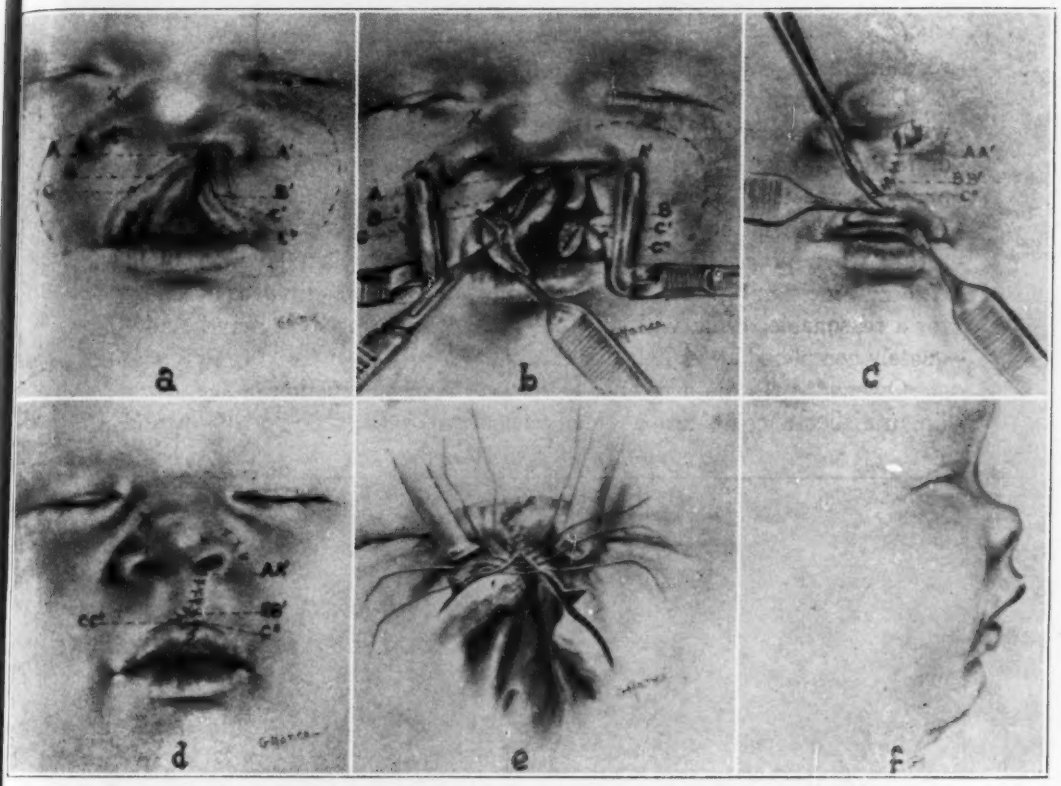


Fig. 7.—(*a*) The line *ABC* and *A'B'C'* are lightly incised with a knife. The incision is carried upward from *C'* on the mucocutaneous junction to separate the vermilion from the skin. This is also done at *A* to keep any vermilion out of the nostril floor. The circular dotted lines show the area which is to be undermined at the next step. (*b*) The lightly incised lines *ABC* and *A'B'C'* are cut completely through the lip with a stab blade, with care to keep the knife exactly perpendicular to the lip. All angles should be completely opened. The vermilion is inspected, and any attached skin is removed with a stab blade. The rectangular flap freed from *A'B'C'* must be loose enough to be rotated up 180 degrees into the nostril floor. Dotted lines indicate the area undermined. (*c*) *A* and *A'* are approximated with a deep stitch of white silk or cotton and no. 000 surgical gut (knot on the mucosal side) and a surface suture of no. 000 black silk. *B* and *B'* are approximated with a fine deep white stitch and a black one on the surface. Intervening fine surface sutures are placed, and an oblique cut is made in the vermilion flap from *C'*. For the incisions and trimming, fine, sharp scissors are most useful. (*d*) *C* and *C'* are united, and the vermilion flaps are interdigitated in a zigzag fashion, fitting them so that they lie naturally together without any pull or stretching. Suturing is then continued on around the vermilion border and up the inside to the fornix. The little flap in the nostril is trimmed to fit with the one from the opposite side, and they are sutured together to form the floor. A few key mattress sutures are placed through the ala to unite the lining and covering (which were separated during the undermining). (*e*) The mucosal suturing is important and is done with fine interrupted stitches and careful trimming to fit the edges together. The upper corners are rounded somewhat, and the suturing is continued to pull some mucosa into the lip from either cheek. This advances the whole lip and thrusts it forward. If the superior edge of the mucosa is tight, vertical slits are made on either side and allowed to spread open. (*f*) Normal profile of an infant, showing the upper lip far in advance of the lower and the flexion crease in the upper lip with the forward thrust of its lower border. This gross contour of the upper lip and its relations to other features is visible and noticeable at a greater distance than are some of the finer details of the lip. (After Brown and McDowell.)

(*Comment.*—This is an important communication, which should be read in the original.)

Deformity of the nose as well as that of the lip identifies the patient with harelip, according to Lamont.[89] Unless the lip is grossly too long or too tight, complicating secondary repair, a reasonable reconstruction may be expected. However, unless the nose, too, is reconstructed, the final picture will be found wanting. The surgeon might weigh the future when proceeding with primary repair and when possible avoid external incision on the nose. Tissues may be readjusted to allow for a reasonable result, with the thought that the procedure may be adequately completed at some later time.

Owens [90] presents a technic for complete reconstruction of the lower lip, utilizing a combination of advancement of flaps of both skin and

Fig. 8.—Repair of wide single cleft by method described. The normal-appearing forward thrust of the lower portion of the lip was obtained by the use of a small flap in the lower one third of the lip with the mucosal suturing. (After Brown and McDowell.)

mucous membrane. This procedure was described in the "Contributions to Plastic Surgery During 1944" and is an important contribution. The technic is demonstrated in figure 9.

Harris [91] expresses dissatisfaction with the operative technics described in various texts for the correction of macrostomia and gives

89. Lamont, E. S.: Reparative Plastic Surgery of Secondary Cleft Lip and Nasal Deformities, Surg., Gynec. & Obst. **80**:422 (April) 1945.

90. Owens, N.: Simplified Method of Rotating Skin and Mucous Membrane Flaps for Complete Reconstruction of the Lower Lip, Surgery **15**:196 (Jan.) 1944.

91. Harris, H. I.: New Technic for Correction of Macrotomia, J. Oral Surg. **3**:156 (April) 1945.

a new procedure, which in his hands has been more successful. This technic differs from the usual procedures in that a mucous membrane flap is utilized to form a normal vermilion border for the corrected angle of the mouth.

(*Comment.*—The tongue and notch procedure, used by the late Dr. John Wheeler for reduction of a long palpebral fissure, may also be used for macrostomia, with success.)

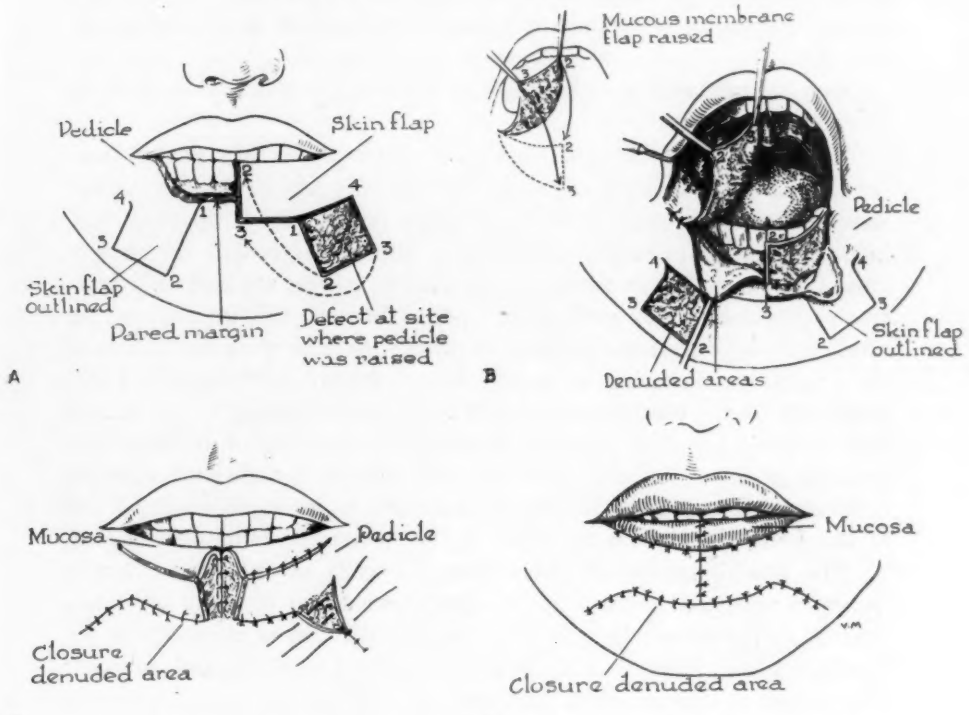


Fig. 9.—*A*, drawing showing the flap outlined on the right and the flap dissected up on the left to include skin, fat and a portion of the triangularis muscle. The flap on the left has been swung up into its proper position for its incorporation with the mucous membrane in reconstruction of the lip. *B*, advancement of the mucous membrane flap on the right cheek as it comes forward to join the skin and muscle flap. The mucous membrane flap on the left has already been advanced for the reception of the skin and muscle. *C*, attachment of each composite flap with the other as they are joined in the final approximation to complete the newly formed lip. *D*, completion of the reconstruction.

Treatment of gunshot wounds of the jaws is divided by Converse [92] into three distinct periods. The first, or early, phase, which extends from the time of injury to one or two days after injury, is the most

92. Converse, J. M.: Early and Late Treatment of Gunshot Wounds of the Jaws in French Battle Casualties in North Africa and Italy, J. Oral Surg. **3**:112 (April) 1945.

critical for the patient. This is the period of asphyxia, loss of blood, shock, pain and mental depression. After this critical first period the patient enters the second phase, during which the treatment consists in the immobilization of the fragments of bone by means of ligatures or splints. The late primary suture of the wounds may be carried out in this prereconstructive phase. The third period is the reconstructive phase proper, which follows healing of the tissues and often evacuation of the patient to the zone of the interior. At this time reconstructive plastic operations, frequently interrupted by periods of convalescence, are started.

In a comprehensive article on fractures of the mandibular condyle, Thoma [93] concludes:

1. The ordinary treatment of these fractures is not always successful. 2. With children, spontaneous readjustment of the mandibular joint, epiphysial growth of the condyle and positioning of the teeth will, in time, greatly aid in the correction of minor defects that are present after treatment. With adults, better results can be attained by operative procedures. 3. A method for open reduction with internal wiring fixation is advocated for patients in whom there is wide separation of the fragments, disposing to nonunion, or extreme overriding and displacement of the condyle that would result in shortening of the ramus and in open bite. 4. Another method of reduction of fracture dislocation involves immobilization of the condyle by skeletal fixation. 5. Functional treatment should be instituted to reestablish normal use of the joint even before fractures in the horizontal rami have healed.

The ameloblastoma develops from the cells of the enamel organ during a particular phase of tooth development and is found most frequently in the mandible, less so in the maxilla and occasionally in the pituitary gland, tibia, ulna and ovary, according to Byars and Sarnat.[94] The tumor is slow growing and, unless completely removed, will continue to grow (rather than recur). The ameloblastoma seldom becomes truly malignant. The lesion should be (1) completely enucleated if unilocular, (2) cauterized by heat if multilocular and not too large or (3), if extensive, resected, a small amount of normal bone being included. The surgical approach for removal of the tumor and plastic procedures for repair of the subsequent deformity are described in the article.

From a review of 1,200 cases of casualties, Oldfield [95] concludes that some progress has been made in the treatment of the maxillofacial

93. Thoma, K. H.: Fractures and Fracture Dislocations of the Mandibular Condyle, J. Oral Surg. **3**:3 (Jan.) 1945.

94 Byars, L. T., and Sarnat, B. G.: Surgery of the Mandible: The Ameloblastoma, Surg., Gynec. & Obst. **81**:575 (Nov.) 1945.

95. Oldfield, M. C.: Some Experiences of Reparative Surgery in the Middle East (Short Review of 1200 Cases), Brit. J. Surg. **32**:237 (Oct.) 1944.

type of war injury. The main factors to which the author ascribes this progress are (1) increase and improvement in air evacuation of wounded patients; (2) improvement in the application of the sulfonamide group of drugs; (3) efficiency of the blood and plasma transfusion units in the forward areas; (4) intratracheal administration of anesthesia with pentothal induction, and (5) external pin fixation in the troublesome fractures of the mandible and malar.

Tholan [96] has observed that one of the causes of failure in the closure of large oral antral fistulas is the delicacy of the buccal flap and the tendency of the heavy palate flap to return to its normal position. This pull causes the sutures to cut off the buccal flap before union occurs.

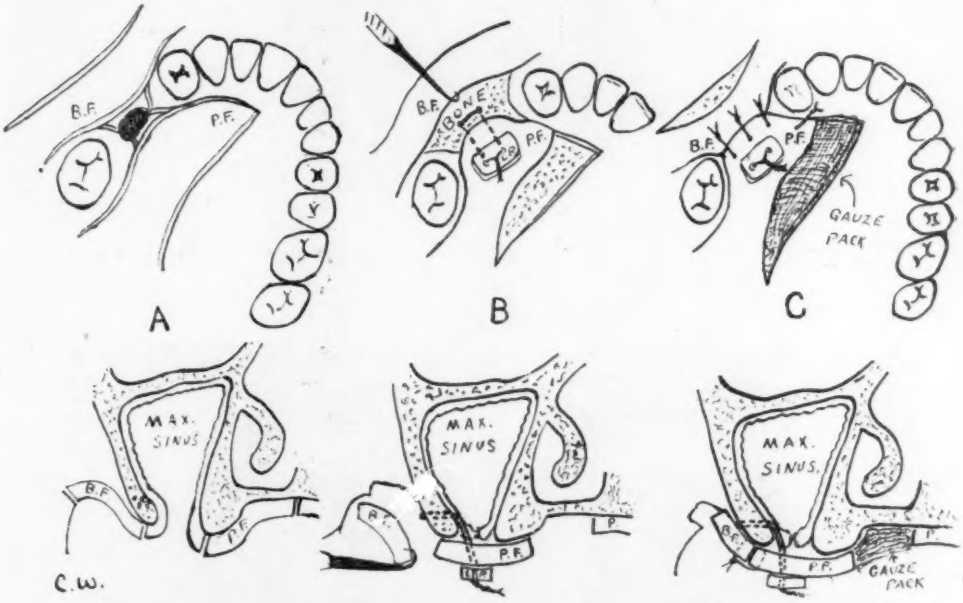


Fig. 10.—Palatal and transverse vertical diagrams of repair of oral antral fistula. *A*, incisions for raising mucoperiosteal palate flap (*P.F.*) and buccal double pedicle flap (*B.F.*). *B*, palate flap secured over the fistula by means of wiring through bone on the buccal side and twisted over small lead plate on the palate flap. *C*, buccal and palatal flaps sutured in apposition. Sensitivity of the exposed palatal bone may be controlled by protecting it with ribbon gauze lubricated with an anesthetic antiseptic ointment. This may be secured in position by sutures—cross palate wiring—or a clear acrylic palate-protecting splint. (After Tholan.)

In order to overcome this difficulty, Tholan places a wire mattress suture between the outer bony wall of the fistula and the palate flap, thereby anchoring the flap in the desired position. The wire drawn under the mucoperiosteum on the buccal side is anchored in the palate flap over

96. Tholan, E. F.: Closure of Oral Antral Fistula, J. Oral Surg. **3**:255 (July) 1945.

a lead plate. The author makes a nasal antral window under the inferior turbinate for drainage in all cases of fistula associated with infection of the antrum.

(*Comment.*—An experienced plastic surgeon such as Tholan can successfully close a large oral antral fistula by the one stage method.

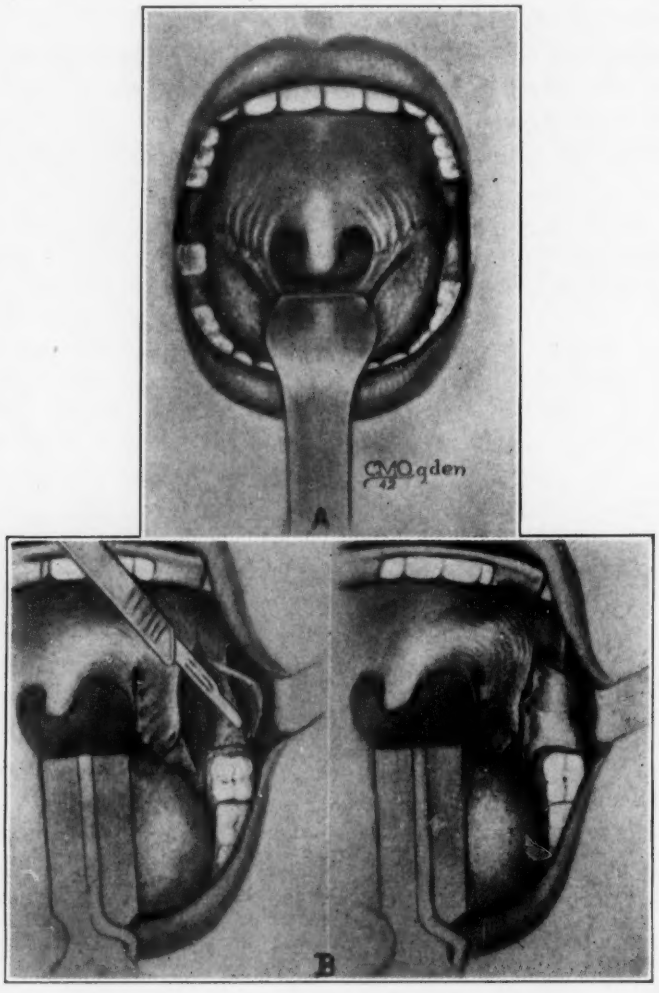


Fig. 11.—*A*, extreme constriction of the oropharynx due to scar tissue adhesions of the tongue and tonsillar fossae and pillars. *B*, Left: buccal mucosa freely undermined to permit its sliding medially to cover the defect produced by shifting flap to restore the pharynx. Right: buccal mucosa sutured over the defect. (After Kazanjian.)

The occasional operator, however, should outline and replace the palate flap (or both flaps) as a preliminary procedure to insure adequate blood supply. Two weeks later the operation may be safely completed.

Stenosis of the oropharynx, a rare condition, is characterized by the presence of scar tissue causing constriction of the soft palate, the tonsil region and the base of the tongue, according to Kazanjian.[97] While these bands of scar tissue may be caused by ulcerative lesions such as syphilis, diphtheria, tuberculosis or contact with caustics, the commonest cause seems to be tonsillectomy. The bands of scar tissue are more likely to occur when the lingual tonsils are removed at the same time that the tonsils are enucleated. In such cases there is likely

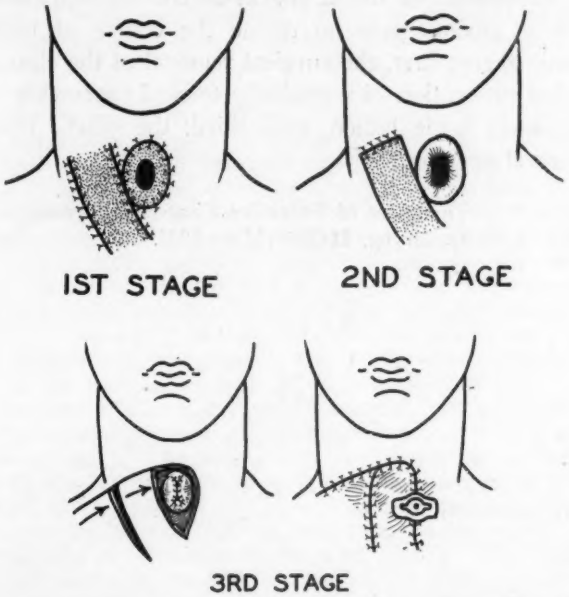


Fig. 12.—*1st stage,* plastic closure of a large tracheal opening. A circular incision is made around the free edge of the tracheal opening and about 2 cm. from it. The skin within this incision is undermined, as is illustrated by the dotted area. This forms a flap, which is sutured back in position. A ribbon flap of skin is elevated below and to one side of the tracheal opening. This flap is left attached at both ends for a blood supply but is completely undermined, as is illustrated by the dotted area. The flap is sutured back in position at this stage. *2nd stage,* the superior pedicle of the skin is cut across and sutured back in place. This severs the blood supply from the upper end of the flap and increases the blood supply from the lower pedicle. *3rd stage,* the circular flap of skin around the tracheal opening (see *1st stage*) is reelevated, folded back on itself and sutured to form a lining for the tracheal opening. The skin lateral to this flap is undermined and stretched mesially to cover the bed of tissue from which the flap was elevated. A no. 1 tracheal cannula is inserted into the trachea for a period of three to five days. (After Erich.)

to be a continuous raw area extending from the tonsillar fossa to the side of the tongue, and when healing takes place each side of the tongue is gradually drawn into its tonsillar fossa. Operative repair

97. Kazanjian, V. H.: Stenosis of the Oropharynx, J. Oral Surg. **3**:164 (April) 1945.

consists in freeing the bands of scar tissue and covering the resulting raw area with rectangular pedicle flaps from the anterior pillars, the postmalar region and the cheek.

Erich [98] reports that cicatricial stenosis of the larynx or the upper part of the trachea usually can be treated most successfully by an open operation through an incision in the neck. Such direct exposure permits accurate excision of the thickened scar tissue producing the stricture. In the cases in which this precise method of reestablishing the normal dimensions of the laryngeal or the tracheal lumen is to be employed, it is advantageous to divide the course of treatment into three separate stages: first, the surgical removal of the cicatrix; second, the mechanical prevention of a tendency toward narrowing or constriction of the newly made lumen, and, third, the plastic closure of the external tracheal opening.

98. Erich, J. B.: Treatment of Extensive Cicatricial Stenosis of the Larynx or the Trachea, Arch. Otolaryng. **41**:343 (May) 1945.

# Abstracts from Current Literature

## Ear

THE USE OF RADIUM IN THE AEROTITIS CONTROL PROGRAM OF THE ARMY AIR FORCES. Ann. Otol., Rhin. & Laryng. **54**:650 (Dec.) 1945.

This is a combined report of the medical officers participating, from the First, Third, Eighth, Twelfth and Fifteenth Air Forces. Aerotitis was a serious problem both during training of flyers and when they were in combat. In England it was found that frequently men were fit for combat duty only one third of the time because of recurrent aerotitis. Studies showed that there is a striking correlation between the amount of lymphoid tissue about the orifice of the eustachian tube and the incidence of aerotitis. The usual measures, the local use of shrinking agents, the local application of heat and tubal inflation give relief of the acute symptoms, but if infected lymphoid tissue is present in the fossa of Rosenmüller, on the torus tubarius or around the pharyngeal orifice of the tube, recurrence is likely, especially after flying at high altitudes. It was decided to make a study of the use of radium in getting rid of this tissue. All patients were given a complete ear, nose and throat examination, and a history of past performance of ear-ventilating function was obtained and recorded on carefully planned forms. The nasopharyngoscope was used to examine the eustachian orifices, and a diagrammatic sketch of the nasopharynx was made showing the location of the lymphoid tissue at the time of the examination and so was available for use as a basis for determining objective improvement after treatment. In giving the treatment, two nasopharyngeal applicators containing radium were used, each applicator containing 50 mg. of radium sulfate enclosed in a chamber on the end with a wall thickness of 0.3 mm. These were inserted into the nasopharynx and allowed to remain in place for 6.6 minutes, giving a dosage of approximately 1 Gm. per 20 seconds. Later in the program the dosage was increased to 1 Gm. per 25 seconds (8.5 minutes on each side of the nasopharynx). The latter was found more efficient and within the limits of safety. With 0.3 mm. filtration used in the applicator, the rays emitted consist of approximately 30 per cent beta rays and 70 per cent gamma. Only rays absorbed by the tissues are of therapeutic value. Practically all the beta rays are absorbed, most of them in the first 3 mm. of tissue. In contrast, only 6 per cent of the gamma rays which pass through the filter are absorbed by the tissues of the nasopharynx. With these applicators, 8.5 minutes of exposure is the maximum which may be given with safety. In clinics where only one applicator is available, one side may be treated for 8.5 minutes, then the other for a similar period immediately afterward. The patient lies down for the treatment, and topical anesthesia is used. The exact location and the depth from the external nares to the area to be treated can be determined by use of a dummy applicator or calibrated rod on one side and the nasopharyngoscope on the other. The middle, and not the end, of the chamber must be in direct contact with the area to be treated. When in place the applicator is fixed with a clamp or adhesive tape. The applicator should never be bent. As a rule, a course of three treatments is given at intervals of not less than twenty-five to thirty days. Undesirable reaction may follow shorter intervals. Treatment should not be given in the presence of an acute infection of the upper respiratory tract. In the presence of subacute nasopharyngitis, one half of the usual dose should be given at that time and the other half five days later. The best protection for those giving the treatment is distance. The radium treatment rooms were 20 feet (6.1 meters) or more from the examining rooms. During the treatment the operator goes away from the patient. The applicator is held as briefly as possible and as far away from the body as possible. The applicator must never be cleaned

with cotton held in the hand, but a soft brush fastened on the sink is used. The thumb and finger should not be used to raise the tip of the patient's nose while inserting the applicator. Monthly blood counts will show any susceptibility of the worker's white blood cells to irradiation.

The results showed that individual response to the effects of the radium varies considerably. In some a pronounced regression was noted after one or two treatments, and in others as many as four or five treatments were required. In the five Air Forces participating, 14,345 men received initial examination, and 6,881 were selected for treatment. Fourteen thousand and forty-five individual treatments were given. No reaction other than a mild stuffiness of the nose, a slight sore throat or a sensation of head cold was observed, and these only in a small proportion. Not a single burn or ulceration of the nasopharyngeal or nasal mucosa was seen. The outstanding over-all finding was that the subjective improvement paralleled the objective improvement, and the observers consider this conclusive proof that removal of the offending lymphoid tissue by irradiation eliminates the cause of aerotitis. The value of irradiating minimal amounts of lymphoid tissue located in critical areas about the tubal orifice was shown in 55 of 66 men in this category who had had previous ear-ventilating difficulties. Analysis of patients who failed to improve revealed that some had huge masses of lymphoid tissue in the nasopharynx, that irradiation alone was not sufficient and that surgical removal combined with irradiation would have been better. Others showed lesser amounts of lymphoid tissue which was resistant to irradiation. Additional treatments would probably have produced the desired results. A third group showed a definite decrease in the amount of lymphoid tissue but no improvement in the aural condition. In some of these there was a definite psychologic element, and in others various factors such as nasal allergy, chronic sinusitis and hypertrophy of the posterior ends of the inferior turbinates were a contributing cause. In a small group no adequate explanation for lack of improvement was found.

M. V. Miller, Philadelphia.

The Fenestration Operation for Otosclerosis. George E. Shambaugh Jr., J. A. M. A. **130**:999 (April 13) 1946.

In the beginning of this article Shambaugh outlines briefly the development of the labyrinth fenestration operation from the early experimental efforts of Passow and Jenkins through the advancements contributed by Holmgren and Sourdille to and including the most recent modifications of the operation by Lempert and himself. He emphasizes the importance of his irrigating apparatus and the dissecting microscope in the creation of the fistula.

Shambaugh describes the results obtained in his experimental studies of labyrinthine fistulas in monkeys during a period of four years. These studies indicate that the following factors govern osteogenesis tending to close the fistula: (1) the sluggish response to trauma of the enchondral layer of the labyrinthine capsule; (2) the inhibiting effect of stratified squamous epithelium on osteogenesis; (3) the stimulating effect of bone dust and fragments on osteogenesis; (4) the stimulating effect on osteogenesis of trauma to the endosteum within the labyrinth; (5) the inhibiting effect on osteogenesis of a smooth polished bone surface, and (6) the tendency of the intact membranous labyrinth closely adherent to the skin flap to hold the mouth of the fistula open.

In a study of the permanence of the hearing improvements after the fenestration operation Shambaugh analyzes 930 consecutive fenestration operations performed between July 1938 and December 1945. To date, in 53 of these 930 cases hearing improvement had been lost. Reoperation was carried out in 30, and in every instance the hearing loss was found to be due to new bone closing the fistula. Of the fistulas that closed 82 per cent did so within one year after operation. As a result of the technic used by Shambaugh for the past four years, namely the Lempert "nov-ovalis" operation with the addition of the constant irrigating apparatus and the microscope, 92 per cent of the patients showed a permanent improvement in hearing at the end of two years. Four per cent of the patients lost

part but not all of their improvement, and the average improvement for this 4 per cent is now 21.7 decibels. The average gain for the 88 per cent that maintained their maximum improvement in hearing for more than two years is 28.9 decibels.

Shambaugh's studies have indicated that the osteogenesis tending to close the fistula is most active during the first few months after operation, after which the processes of healing approach completion, and osteogenesis becomes less active. After the second postoperative year all osteogenesis as a rule has ceased, and an open fistula with a maintained improvement in hearing at that time may be regarded as almost certainly permanent.

CAMPBELL, Philadelphia.

CORRELATIONS BETWEEN BONE AND AIR CONDUCTION ACUITY MEASUREMENTS OVER WIDE FREQUENCY RANGES IN DIFFERENT TYPES OF HEARING IMPAIRMENT. D. M. LIERLE and SCOTT N. REGER, Laryngoscope **56**:187 (May) 1946.

There are many difficulties in obtaining of accurate bone conduction with tuning forks. The usual audiometer bone conduction receiver may also be somewhat unreliable. The Sonotone Corporation has developed a new type of electrically activated bone conduction receiver. This receiver and the technic of its use are described. The results obtained with it are noted. It was superior to tuning forks and other bone conduction receivers.

The unique construction reduces the possibility of air-borne sound being heard by air conduction before the threshold for bone conduction is reached. A head band was constructed to hold the vibrator so that a uniform pressure was exerted against the bone. Other features are noted. For example, one can make direct immediate comparison between air and bone conduction acuity; it can be used over a wider range of frequencies and with greater intensities than forks, and the Gellé, Bing and occlusion tests can be made more accurately. Better Rinne, Weber and Schwabach tests can be made with its use.

There has always been some controversy as to whether or not bone conduction is increased when there is a lesion of the middle ear. Lierle and Reger found a few cases in which it was actually increased, but this did not occur in most cases.

Much criticism has been expressed concerning audiometer bone conduction vibrators. The authors conclude that a properly built vibrator (such as was used in this work) is worth while and will contribute much toward the accurate testing of bone conduction.

An interpretation of the relationships between threshold measurements of air and bone conduction acuity is made.

HITSCHLER, Philadelphia.

AERO-OTITIS EXTERNA. (A SYNDROME RESULTING FROM THE USE OF EARPLUGS IN FLIGHT.) BEN H. SENTURIA and HUBERT B. PEUGNET, Laryngoscope **56**:225 (May) 1946.

A new syndrome, aero-otitis externa, is described. It is the inflammation of the external auditory canal and ear drum caused by the wearing of ear plugs during rapid descent. Various types of plugs are described and their effects noted. Imperforated plugs cause pressure changes, which in turn cause the inflammation. Such plugs should not be worn when rapid descent is contemplated.

HITSCHLER, Philadelphia.

## Pharynx

CARCINOMA OF THE ORAL CAVITY. EDWIN A. LAWRENCE and PHILIP S. BREZINA, J. A. M. A. **128**:1012 (Aug. 4) 1945.

Of 145 consecutive cases of carcinoma of the oral cavity, the best results were in the groups in which the buccal mucous membranes and anterior parts of the tongue were involved, in which a five year survival rate of 23 per cent was obtained. The poorest result was in the group with hypopharyngeal lesions, in which the five year survival rate was 8 per cent.

If epidermoid carcinoma is to be destroyed, a dose of at least 5,000 r must be delivered into the tumor. This usually requires supplementary interstitial administration of radon in addition to roentgenotherapy. The roentgen radiation should be administered for approximately twenty-one treatment days, and radon seeds should be inserted when the tumor has regressed to its maximum degree.

There is a possible relationship of the prolonged presence of oral infection and carcinoma of the mouth, pharynx and upper part of the gastrointestinal tract. The treatment of carcinoma in the mouth and pharynx is essentially a radiologic problem, since in only a small number of cases are the tumors suitable for surgical removal. To treat metastatic disease successfully, a radical neck dissection must be done early.

HENSCHEL, Denver. [ARCH. DERMAT. & SYPH.]

PENICILLIN IN THE TREATMENT OF VINCENT'S ANGINA. LEWIS H. BRONSTEIN, New York State J. Med. **46**:735 (April 1) 1946.

Bronstein's experience with "the mold" was gained in the Regional Hospital, Fort George G. Meade, Md. Because of the varied response under any treatment of Vincent's angina, Bronstein treated 105 patients. He also treated 32 "controls." The dosage was 20,000 units into the muscles every three hours for eight or sixteen doses according to the appearance of the lesion at first sight. Routine smears were taken at the end of each course and in every case there were no spirochetes! The relief of pain is rapid and from twelve to fourteen hours after treatment has been started the patient is comfortable and can eat.

The controls were treated by oxidizers—peroxide and perborate gargles—rigid dental care and high doses of ascorbic acid, nicotinic acid and thiamine hydrochloride. Time was measured "from the start of the treatment to the day the tonsils looked normal." The average was 6.2 days for the group given penicillin and 8.1 days for the group given oxidizers. It was not possible under war conditions to study recurrences. In the relatively few patients with gingival involvement the organisms disappeared when penicillin was administered but more slowly.

VOORHEES, New York.

## Nose

NASAL PSYCHOSOMATIC SYNDROMES ACCOMPANYING AND FOLLOWING ACUTE ANXIETY. EINFRED L. POST, Ann. Otol., Rhin. & Laryng. **54**:747 (Dec.) 1945.

Members of the combat crews of the Army Air Forces frequently had nasal complaints. Grinker and Spiegel showed that most frequently these symptoms referable to the upper respiratory tract were psychosomatic manifestations of acute anxiety, often not consciously apparent to the subject. The study reported by Post was made at the Don Cc-Sar Convalescent Hospital at which only combat veteran airmen were hospitalized for operational fatigue after their return to the United States. The usual nasal symptoms were hyperesthetic rhinitis, nasal block, block of the eustachian tube and headache. Headaches were only occasionally caused by intranasal pressure, because shrinking of the mucosa did not relieve the symptoms. In the cases reported the connection between nasal block and headache is always noted if the headache is not a primary psychiatric symptom of tension.

The smooth muscle fibers controlling the arterial and venous tracts of the turbinates are innervated through the sympathetic system. Ephedrine and other sympathomimetic drugs cause constriction of these fibers, thus emptying the tissue and enlarging the air passage. Exercise, sudden noises or pain will also bring about this constriction. From the apparent function of the turbinate tissue such a reaction would be expected from such stimuli. They alert the body for action during which an increased oxygen intake is anticipated, a larger nasal passage is needed, and increased mucus is necessary to moisten the added air volume. Patients suffering anxiety reactions long after leaving combat feel consciously or unconsciously as though they were still in dangerous situations calling for action or alerting for action. It is characteristic of the cases of severest war neuroses that

the patient's ability to discriminate between the reality of "safety now" and the memory of "danger in the past" is lost.

A constant discharge of constrictor substances maintains the tonus of the vascular bed. The author's clinical observations indicate that a relaxation of this tonus occurs immediately after acute adrenergic stimulus of an anxiety reaction is past. This vasorelaxation, which allows turbinate congestion, may be due to a negative sympathetic state or the result of a parasympathetic excitation. Secondary results of this after-phase of acute anxiety may be purulent rhinitis, sinusitis and otitis, or these conditions may be prolonged by the relaxation of the tissues.

MILLER, Philadelphia.

ORBITAL COMPLICATIONS FOLLOWING OPERATIONS ON PARANASAL SINUSES. ERIK GODTFREDSEN, Acta oto-laryng. **33**:211 (May-June) 1945.

The literature of orbital complications following surgical treatment of the sinuses is scanty. Godtfredsen's contribution concerns 8 cases of his own occurring in the six year period from 1939 to 1944 together with 42 cases gathered from the literature between 1902 and 1939. The three conditions caused by inflammation, namely collateral edema, subperiosteal abscess and orbital phlegmon, present the usual characteristics. A more important complication is orbital hematoma, which manifests itself by a promptly developed, often severe exophthalmos with a dislocation of the bulb and varying degrees of subconjunctival hemorrhage. Palpebral edema and ecchymoses and chemosis of the conjunctivas are seen.

The most serious complication is a lesion of the optic nerve due to direct instrumental damage or to a long-continued stretching of the nerve in severe forms of orbital hematoma with exophthalmos. Emphysema of the orbit occurs but rarely.

Twenty-four of the fifty complications reviewed followed ethmoid exenterations and thirteen followed radical surgical treatment of the frontal sinus. Interestingly enough, four complications followed puncture of the antrum. Godtfredsen believes that in all cases of orbital complications following ethmoid surgery the complications are the direct result of instrumental perforation of both bone and periorbita, and he lays very little stress on the presence of spontaneous dehiscences as described by Onodi and Sluder. He calls attention to the topographic anatomy of the ethmoid cells in that they lie close to the muscles and motor nerves of the orbit and particularly close to the optic nerve, which they often completely surround. He cautions particularly against prolonged packing.

Conservative treatment is recommended in cases of orbital edema and solitary muscle lesions, but in cases of hematoma of any size he recommends an operation to evacuate the blood, and in cases in which there is any suspician of a lesion of the optic nerve he insists that this should be done within the first twelve to twenty hours after such a lesion is diagnosed. This can be accomplished externally through an ordinary incision for operation on the frontal sinus, or if a perforation of the lamina papyracea is found this perforation can be enlarged, and drainage into the nose established.

GROVE, Milwaukee.

CRYPTOGENIC CEREBROSPINAL RHINORRHEA. STEEN JOHNSEN, Acta oto-laryng. **33**:446 (Sept.-Dec.) 1945.

Johnsen reports 2 cases of spontaneous or idiopathic cerebrospinal rhinorrhea of his own and calls attention to 80 cases which had previously been reported. In his first case a surgical exploration was made, and the defect was found anterior to the right of the crista galli. The right olfactory tract was removed, a small piece of muscle was placed in the defect, the entire lamina cribrosa was covered with a plate of muscle, and the dura was completely sutured. The patient was still well four years after the operation. This discharge of cerebrospinal fluid had occurred quite spontaneously.

In the second case the escape of cerebrospinal fluid followed an acute head cold. In this case a lumbar puncture was done, and when the patient was checked three months later the discharge of cerebrospinal fluid had not reappeared.

In the first case a neurologic examination yielded negative results. In the second case there were choked disks undergoing atrophy but no other neurologic abnormality. Intracranial pneumography revealed that both patients had a dilatation of the ventricle and evidences of increased intracranial pressure. There was no evidence of cerebral tumor, basal arachnoiditis or any other intracranial lesion in either case.

The diagnosis must be established by the absence of mucin in the secretion and by a chemical analysis to establish the same chemical constituents and in the same concentration as are found in the cerebrospinal fluid. Friedberg and Galloway inject a blue dye at lumbar puncture and observe the color in the drippings from the nose.

In most cases of cerebrospinal rhinorrhea the leakage is through the cribriform plate, although in a few the fluid reaches the nose by way of the sinuses. In every case there is an increase in intracranial pressure which probably produces an erosion of the bone. This is usually caused by a cerebral tumor, basal arachnoiditis or congenital hydrocephalus. In the remaining cases the rhinorrhea is designated as idiopathic or cryptogenic because the cause cannot be elicited.

Treatment ranges from prolonged bed rest with elevation of the head to lumbar puncture, the application of silver nitrate to the fistula in the nose and operative intervention, with the use of muscle flaps, tampons, flaps of periosteum and fascia lata. The condition calls for close cooperation between the otolaryngologist and the neurosurgeon.

GROVE, Milwaukee.

PERFORATION OF THE SEPTUM NASI: SOME EXPERIMENTS WITH FASCIA LATA. W. BEHRMAN, Acta oto-laryng. **34**:78, 1946.

The author has not been able to treat successfully conditions with perforated septum by the customary method of fragmenting the mucous membrane on one or both sides, followed by shifting the parts to close in the perforation. Instead, he prefers a free transplantation of fascia lata between the two mucosal layers. Success with this method is enhanced by the use of larger transplants. They afford a better field for more extensive vascular connections between the transplant and the host tissues. The use of sulfathiazole on the operative field also contributes to the favorable outcome. The sulfathiazole gauze is left undisturbed for a week before its removal from the operative field.

SELTZER, Philadelphia.

## Miscellaneous

CIGARETTE SMOKE, IRRITATION AND THE THROAT. NOAH D. FABRICANT, Am. J. M. Sc. **211**:505 (April) 1946.

The author reviews twelve recent articles dealing with irritation of the throat produced by cigaret smoking and adds his own observations. He concludes that methods for determining the irritating properties of cigarets which rely solely on the opinions of ordinary smokers cannot be called reliable. He also states that unsatisfactory conclusions are drawn from experiments on rabbit's eyes and shows that there is no evidence, either clinical or experimental, that diethylene glycol is a less irritating hydroscopic agent than glycerin

DAVISON, Danville, Pa.

RUTIN—A NEW DRUG FOR THE TREATMENT OF INCREASED CAPILLARY FRAGILITY. RALPH L. SHANNO, Am. J. M. Sc. **211**:539 (May) 1946.

Rutin is a crystalline glucoside prepared by alcohol percolation from green buckwheat. Administration of this drug corrects abnormal capillary fragility when such abnormal fragility has been demonstrated by means of the Gothlin technic. This drug shows neither acute nor chronic toxicity when administered to laboratory animals and has been given to human patients daily for a period of sixteen months without producing any toxic effects. The usual dosage for human beings is 20 mg. three times daily. The author has used the drug in several types of cases, including cases of idiopathic pulmonary hemorrhage, with good

clinical results accompanied by decrease in the capillary fragility as measured by the Gothlin technic. Increased capillary fragility is determined by counting the number of petechiae in a given area after a standard blood pressure cuff has been placed around the arm and inflated to a pressure of 35 mm. of mercury for a period of fifteen minutes.

Comment: The use of this test combined with the administration of rutin to those patients having increased capillary fragility might eliminate some of the bleeding following tonsillectomy.

DAVISON, Danville, Pa.

SECONDARY SUTURE IN RECONSTRUCTIVE SURGERY. N. N. BURDENKO, Am. Rev. Soviet Med. **3**:359 (April) 1946.

In plastic operations involving only the skin, pedicle grafting and not the free operation is the method of choice.

SELTZER, Philadelphia.

SEQUELAE FOLLOWING ORAL AND TOPICAL USE OF PENICILLIN. LOUIS KLEINFELD, New York State J. Med. **46**:915 (April 15) 1946.

The general opinion emphasizes the lack of untoward symptoms from penicillin other than urticaria. But Kleinfeld has seen 2 patients who had definite and disturbing symptoms. He reports 6 patients who came under observation. The first swallowed three enteric-coated tablets of 25,000 units each. There were violent cramps and distention. One hour later the patient took three more. No ill effects were reported. The next day one 25,000 unit tablet caused a return of the discomfort. A second patient had similar symptoms following similar ingestion of penicillin tablets buffered with sodium citrate. Patient 3 was given penicillin orally and intramuscularly for "sore throat." Membranous patches appeared in the pharynx which required "weeks to wear off." Penicillin drops were then instilled into the nose. Stomatitis followed an acute attack of rhinitis with discrete red lesions on the hard palate. Glossitis was a later incident. All symptoms cleared up promptly when the penicillin was stopped. Case 4 was reported verbally by Dr. M. C. Myerson. The patient had ulcers on the pharynx, tongue and lips after having been given tablets orally over a four day period. Improvement took place within twenty-four hours after administration of penicillin was stopped. Gingivitis in case 5 with stomatitis occurred after oral administration, but cleared up in one week. Patient 6 had a pustular dermatitis in the nares after penicillin ointment was used, but the condition cleared up promptly after the use of penicillin was stopped. The author suggests that impurities may have been mixed in with the penicillin, especially formaldehyde in case 1, which coated the capsule, but decides finally that "penicillin itself was the common factor."

VOORHEES, New York.

INHALATION TREATMENT OF BRONCHIAL ASTHMA. ALVAN L. BARACH, New York State J. Med. **46**:1002 (May 1) 1946.

Working in the Department of Medicine, College of Physicians and Surgeons, Columbia University and in the associated Presbyterian Hospital, Barach attempted an appraisal of the various technics of inhalational therapy: (1) oxygen, (2) helium-oxygen mixture, (3) positive pressure with either oxygen or helium-oxygen mixture, (4) filtered air, (5) nebulized solutions of vasoconstrictor or vasodilator drugs, (6) nebulized solutions of penicillin and the sulfonamide compounds and (7) ether anesthesia.

Oxygen relieves functional emphysema and requires no physical effort on the part of the patient. About 10 liters per minute are sufficient to "wash out the carbon dioxide expired." A concentration of from 50 to 70 per cent of oxygen can be obtained. Helium-oxygen mixtures under positive pressure may produce dramatic relief of dyspnea. Filtered air may be of "crucial value" when other measures fail completely. This is especially true when exposure to dust, smoke

and fumes gives distress. Epinephrine and neosynephrine hydrochloride may be useful, especially when there is more emphysema than asthma. However, a point of intolerance may be reached if the patient overdoes hand bulb spraying. Penicillin aerosol is still under experiment. Sore throat and tongue may follow overdosage, but gargling and rinsing mouth and throat after each inhalation tends to prevent this disadvantage. Some patients are allergic to penicillin and therefore should not be subjected to it. In the use of any or all of these technics much depends on the cause of the asthma and a patient's tolerance to the method employed.

VOORHEES, New York.

SYMPOSIUM ON ADEQUACY OF TRAINING OF VOICE SPECIALISTS. ARLEIGH B. WILLIAMSON, Quart. J. Speech **32**:145 (April) 1946.

This is a presentation of the opinions of many authorities on the problems of training good speaking voices. In general conclusion the authorities, whose statements furnish the principal material of this study, express uniform dissatisfaction with the present training of voice therapeutists, and a number of them advance definite, well outlined proposals for the improvement of scientific knowledge of voice, of the use of scientific instruments and of clinical methods.

PALMER, Wichita, Kan.

OSTEOMYELITIS OF THE SKULL: ITS TREATMENT WITH PENICILLIN AND REPAIR OF THE DEFECT WITH TANTALUM. M. T. SCHNITKER and W. D. MCCARTNEY, Surgery **18**:94, 1945.

Schnitker and McCartney report 3 cases of acute spreading osteomyelitis of the frontal bone. They believe that penicillin has revolutionized the therapy of osteomyelitis of the skull of sinal origin. It overcomes the infection rapidly, limiting its spread and thus permitting early operation, with primary closure of the wound. The authors use a corneal incision and close the wound primarily without packing, instead of employing the classic inverted T incision and open packing of the wound, thus avoiding a deforming scar of the forehead. The wound is irrigated with solutions of penicillin through a catheter left in the incision. It is felt that penicillin should be regarded as a bacteriostatic agent. It limits the spread of infection and permits early removal of the infecting nidus. In a few cases recovery occurred after use of penicillin alone, usually in the absence of sequestration.

The infection (nonhemolytic staphylococcus) in the first case reported was well controlled with penicillin but could not be eradicated with this drug. The infection was apparently cured on two occasions but recurred with cessation of treatment with penicillin, which had been administered in doses of 240,000 units daily. A rapid recovery was made after the entire skull anterior to the coronal suture was removed in one piece. A tantalum plate was used to repair the resulting defect in the frontal bone and was inserted seven months after the initial operation.

In the second case osteomyelitis of the frontal bone (aerobic nonhemolytic streptococcus and nonhemolytic Staphylococcus albus) had not responded to sulfonamide therapy and local operations on the sinus. Twelve days after the beginning of penicillin therapy (200,000 units daily) the infection was apparently controlled, and the entire osteomyelitic area was removed through a coronal incision in one piece. The defect was repaired with a tantalum plate, inserted six months later.

In the third case osteomyelitis of the frontal bone was controlled with prolonged penicillin therapy and external, radical excision of the frontal sinus. In this case there was evidence of a mass lesion involving the left frontal lobe. Repeated exploration of this area with the needle gave negative results, and it was concluded that edema of the brain underlying the osteomyelitis was the cause of the symptoms of cerebral abscess.

SHENKIN, Philadelphia. [ARCH. NEUROL. & PSYCHIAT.]

# News and Comment

## SIMULTANEOUS EDUCATION OF DEAF CHILDREN AND THEIR PARENTS

Normal life in a world of silence for deaf children is the principal aim of a new experimental demonstration class at the Cleveland Hearing and Speech Center, a Community Chest agency affiliated with Western Reserve University.

This educational experiment has been made possible by a grant from the Harry Coulby Fund of the Cleveland Foundation and will not only educate deaf children to speak and to understand speech but will train both parents and teachers.

Eight children between the ages of 2½ and 3½ years have been selected for the class, which will run from 9:00 to 11:30 a. m., five days each week until June. This age group was selected because the minds and bodies of the children are ready for speech and language training. Parents' ability to pay for this class work has not in any way affected the selection.

Mothers of the children attend regular classes for their own education, so that they may carry home the technics used in the teaching of the deaf. They sit and watch in an anteroom back of a large one way vision window, which permits them to see the children in the classroom without themselves being seen. They also have reading assignments such as those given college students.

Dr. Rachel Dawes Davies, assistant professor of hearing and speech therapy at Western Reserve University and supervisor in hearing in the Department of Special Education of the State of Ohio, and Dr. Warren H. Gardner, professor of hearing and speech therapy and director of clinical services at the center, are in charge of the project.

## EXAMINATIONS FOR THE CERTIFICATION OF SPECIALISTS

The American Board of Otolaryngology will conduct the following examinations in 1947:

April 16 to 19 in St. Louis, at the Coronado Hotel.

October 7 to 11 in Chicago, at the Palmer House.

## THE SCIENTIFIC EXHIBIT, ATLANTIC CITY SESSION OF THE AMERICAN MEDICAL ASSOCIATION

At the Atlantic City Session, June 9 to 13, 1947, the American Medical Association will observe its centennial anniversary. For almost half of those hundred years—since 1899—the Scientific Exhibit has been a feature of each annual session and has developed into a short course in graduate medical instruction.

Exhibits at the 1947 Session will cover all phases of medicine. A certain amount of historical material will be included, but emphasis will be placed on the latest developments of medical science. The representative to the Scientific Exhibit from the Section on Dermatology and Syphilology is Dr. Francis W. Lynch, 350 St. Peter Street, St. Paul.

Applications for space should be submitted as early as possible, since the closing date is Jan. 13, 1947. Application blanks may be obtained either from Dr. Lynch or from the Director, Scientific Exhibit, American Medical Association, 535 North Dearborn Street, Chicago 10.

## A GRADUATE COURSE IN BRONCHOSCOPY

An intensive graduate course in otorhinolaryngologic bronchoscopy will be given by Prof. Georges Portmann, of the University of Bordeaux, France, in Georgetown Medical School, Washington, D. C., for two weeks, beginning April 7, 1947. Inquiries should be addressed to: Dr. James A. Flynn, 1511 Rhode Island Avenue, N.W., Washington, D. C.

# Directory of Otolaryngologic Societies *

## INTERNATIONAL

### First Pan-American Congress of Oto-Rhino-Laryngology and Bronchoesophagology

President: Dr. Gordon B. New, Mayo Clinic, Rochester, Minn.
Secretary: Dr. Chevalier L. Jackson, 255 S. 17th St., Philadelphia 3.

## NATIONAL

### American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. J. Mackenzie Brown, 1136 W. 6th St., Los Angeles.
Secretary: Dr. Fletcher D. Woodward, 104 E. Market St., Charlottesville, Va.
Place: Atlantic City. Time: June 9-13, 1947.

### American Academy of Ophthalmology and Otolaryngology

President: Dr. Alan C. Woods, Johns Hopkins Hospital, Baltimore 5.
President-Elect: Dr. C. H. McCaskey, 20 N. Meridian St., Indianapolis, Ind.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100–1st Ave. Bldg., Rochester, Minn.
Place: Palmer House, Chicago. Time: Oct. 12-17, 1947.

### American Broncho-Esophagological Association

President: Dr. Robert M. Lukens, Medical Arts Bldg., Philadelphia 2.
Secretary: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago 11.
Place: St. Louis.

### American Laryngological Association

President: Dr. Frank R. Spencer, Physicians Bldg., Boulder, Colo.
Secretary: Dr. Arthur W. Proetz, Beaumont Bldg., St. Louis.
Place: St. Louis. Time: April 23-24, 1947.

### American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Harry W. Lyman, 906 Carleton Bldg., St. Louis.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: St. Louis. Time: April 25-26, 1947.

*SECTIONS:*

Eastern.—Chairman: Dr. Robert F. Ridpath, 18th and Chestnut Sts., Philadelphia.
Place: Philadelphia. Time: Jan. 13, 1947.
Southern.—Chairman: Dr. Walter T. Hotchkiss, 541 Lincoln Rd., Miami Beach, Fla.
Place: Miami, Fla. Time: Jan. 6, 1947.
Middle.—Chairman: Dr. Oliver E. Van Alyea, 135 S. La Salle St., Chicago.
Place: Chicago. Time: Jan. 20, 1947.
Western.—Chairman: Dr. Colby Hall, 1136 W. 6th St., Los Angeles, Calif.
Place: Los Angeles. Time: Jan. 25-26, 1947.

### American Otological Society

President: Dr. William E. Grove, 324 E. Wisconsin Ave., Milwaukee, Wis.
Secretary: Dr. Gordon D. Hoople, 713 E. Genesee St., Syracuse, N. Y.
Place: St. Louis. Time: April 21-22, 1947.

### American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, Inc.

President: Dr. Alfred Schattner, 115 E. 61st St., New York.
Secretary: Dr. Norman N. Smith, 291 Whitney Ave., New Haven, Conn.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

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